



California Energy Commission

**PIER Buildings Program
Technical Review
October 21 and 22, 2002**

PIER Buildings Team

Nancy Jenkins, P.E. Team Lead
Martha Brook, P.E.
Steve Williams, Supervisor
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Proposed Agenda

- Mission and Issues - 20 min
- Portfolio Balance Overview - 25 min
- Implementation Approach - 25 min
- Portfolio Content Overview - 2 hours
- Collaborations - 25 min
- Market Connections - 1 hour
- Lessons Learned - 15 min
- Future Work - 20 min
- Discussion/Questions - 1 hour



Overall Approach Develop Plans



■ Develop Plans

- What is our mission?
- Identify energy issues facing California that public interest energy research can and should address
 - From these issues, determine research needs/opportunities



Overall Approach Implement Plans



■ Implement Plans

- Develop implementation approaches that creatively and effectively meet our goals while addressing our constraints (limitations in staff resources, travel budget, state contracting, etc)
- Form strategic relationships with industry and other energy organizations to avoid duplication, leverage value, identify collaborative opportunities
- Effective and efficient contract management
 - Critical to R&D success



Overall Approach Evaluate and Re-Calibrate



■ Evaluate Program On Several Different Levels:

- PIER Buildings portfolio balance
- PIER Buildings portfolio content and products
- PIER Buildings impact on the marketplace
 - Qualitative and quantitative
- Overall PIER Program
 - PIER Buildings contribution to overall program goals and objectives

■ Re-Calibrate Program Directions Based on Evaluation Results and Lessons Learned



Mission

- **Mission:**

Decrease building energy use in California through the development of energy efficient technologies and designs, and improved construction and operational practices.



Issue 1



- **Issue 1. Energy consumption is increasing in hotter, inland areas as new building construction increases in these areas.**

- Building loads and energy consumption for lighting, air conditioning, and other equipment, particularly during peak periods, can lead to system outages. Research is needed to investigate energy efficiency, load shifting, distributed generation, and real-time energy consumption information options in both new and existing buildings.



Issue 2



- **Issue 2. Development of energy efficient products and services does not adequately consider non-energy benefits, such as comfort, productivity, durability, and decreased maintenance.**

➤ Comfort and productivity are primary drivers in investment in energy efficient products or strategies. Understanding of the benefits and costs of energy efficiency, comfort and productivity is needed for both new and existing building applications to improve the design, adoption, and use of energy efficient products and strategies.



Issue 3



- **Issue 3. Building design, construction, and operation of energy features can affect public health and safety.**

➤ Building construction, operation of ventilation systems, and certain building materials may contribute to moisture problems and indoor air pollution. Research is needed to construct new buildings and operate existing buildings in a manner that is both energy efficient and healthy.



Issue 4



■ Issue 4. Investment in energy efficiency affects building and housing affordability and value, and the state's economy.

- Research is needed to develop new energy-efficient technologies, including currently undefined innovative advancements, which improve housing and non-residential building affordability and value through energy efficiency. Additionally, optimization of buildings and equipment to be responsive to California climates and development of improved construction techniques and tools are needed to reduce costs associated with the construction of new buildings and operation of existing buildings.



Common to All 4 Issues



- In all four issues, maximizing market connectedness is a common goal.

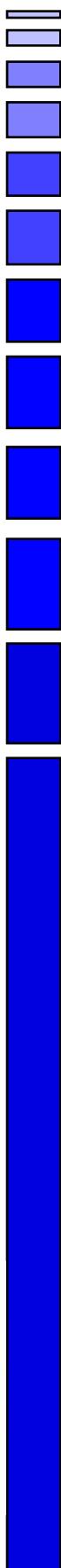
- This will be accomplished through targeting research on technologies and building practices that are responsive to market needs or can motivate greater market demand for energy efficiency.

- In some instances this may necessitate first developing a better understanding of market performance characteristics and market motivations.

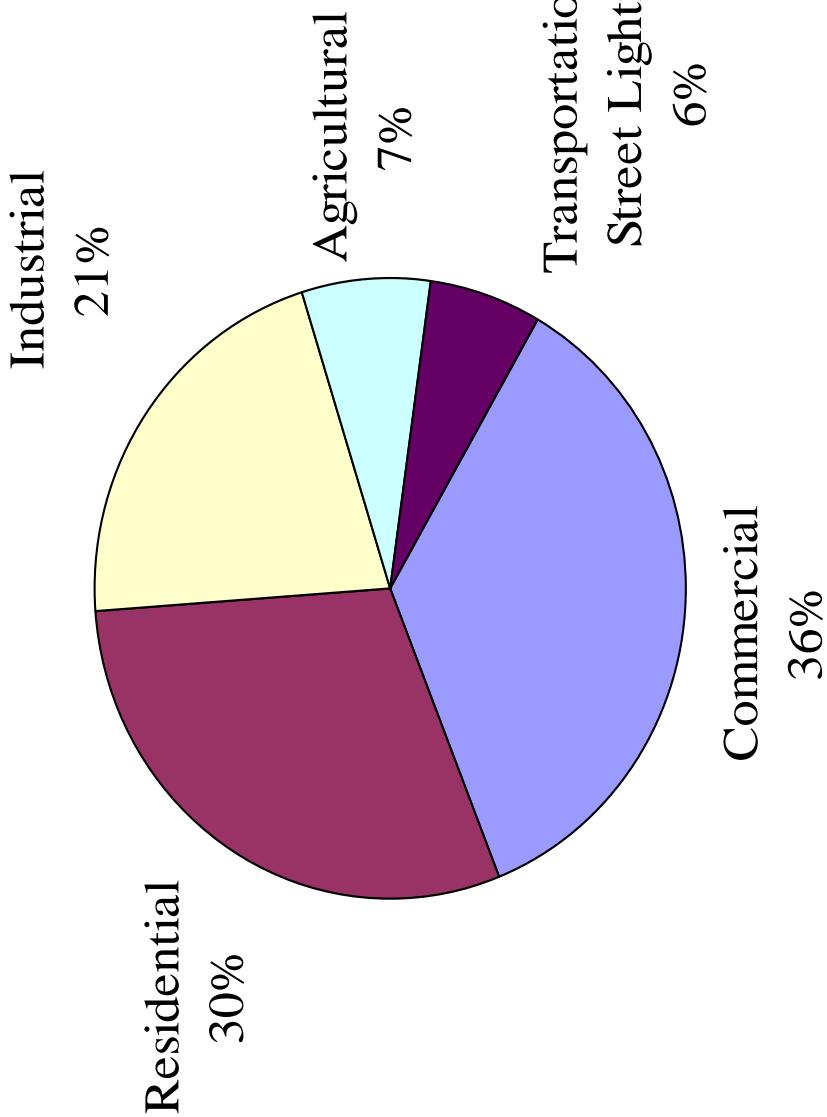


Portfolio Balance

Background - Energy Use (Total)



California Electricity Consumption
(Year 1999 - 251,600 GWh)

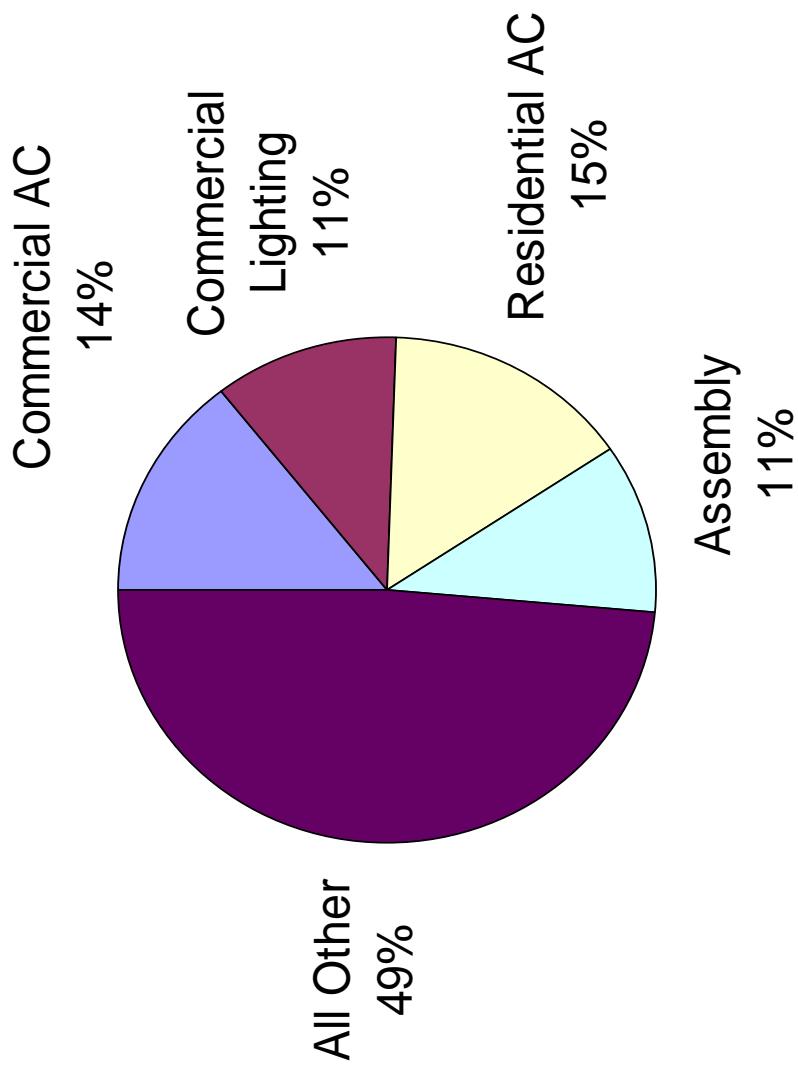




Portfolio Balance Background - Peak Demand



**California Statewide Coincident Peak Demand
(1999 - 49,643 MW)**



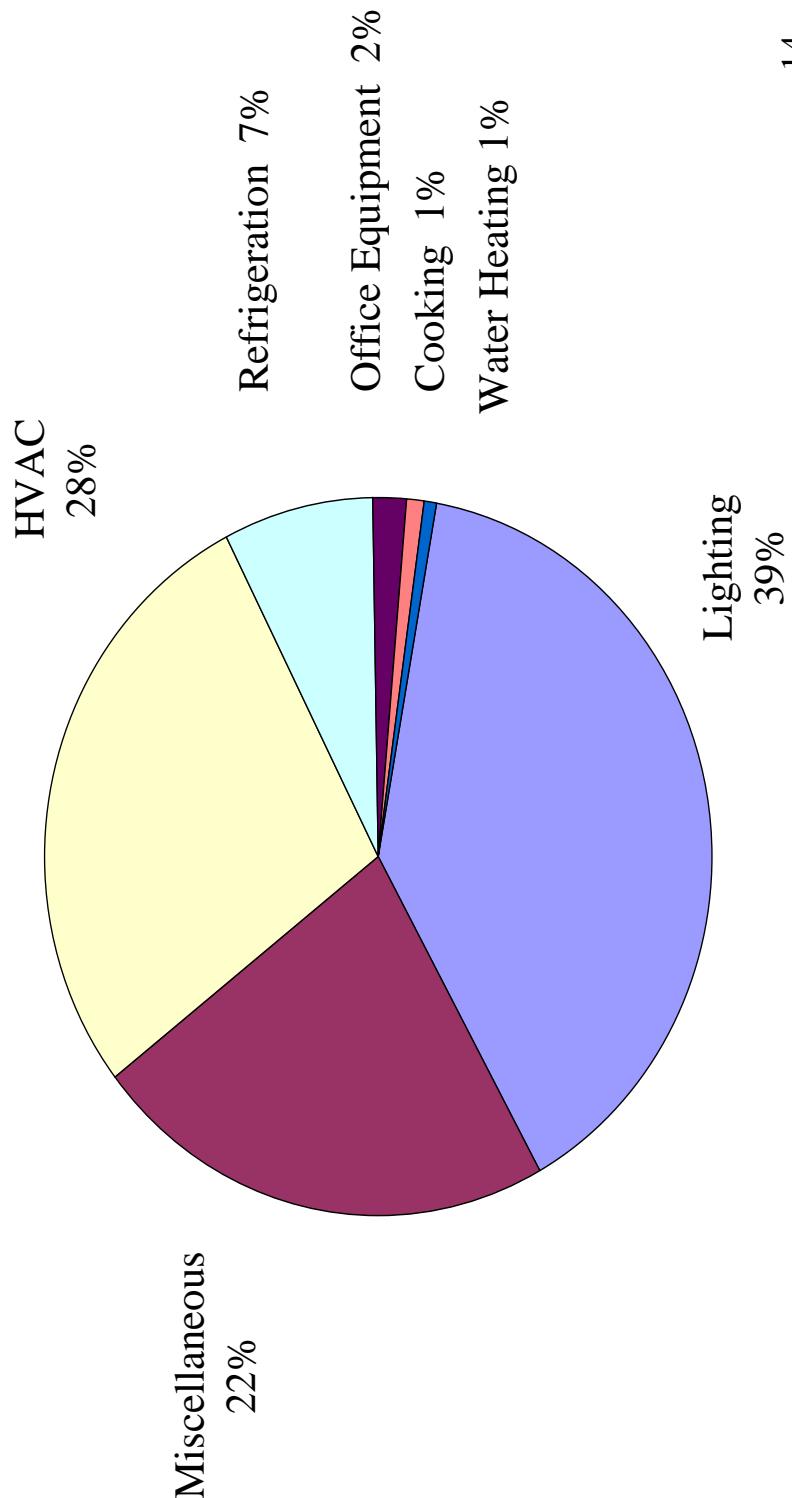


Portfolio Balance

Background - Energy Use (Commercial)



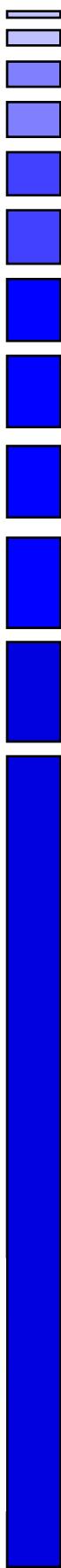
Commercial Annual Electricity Consumption
(Year 2000, 91,771 GWh)



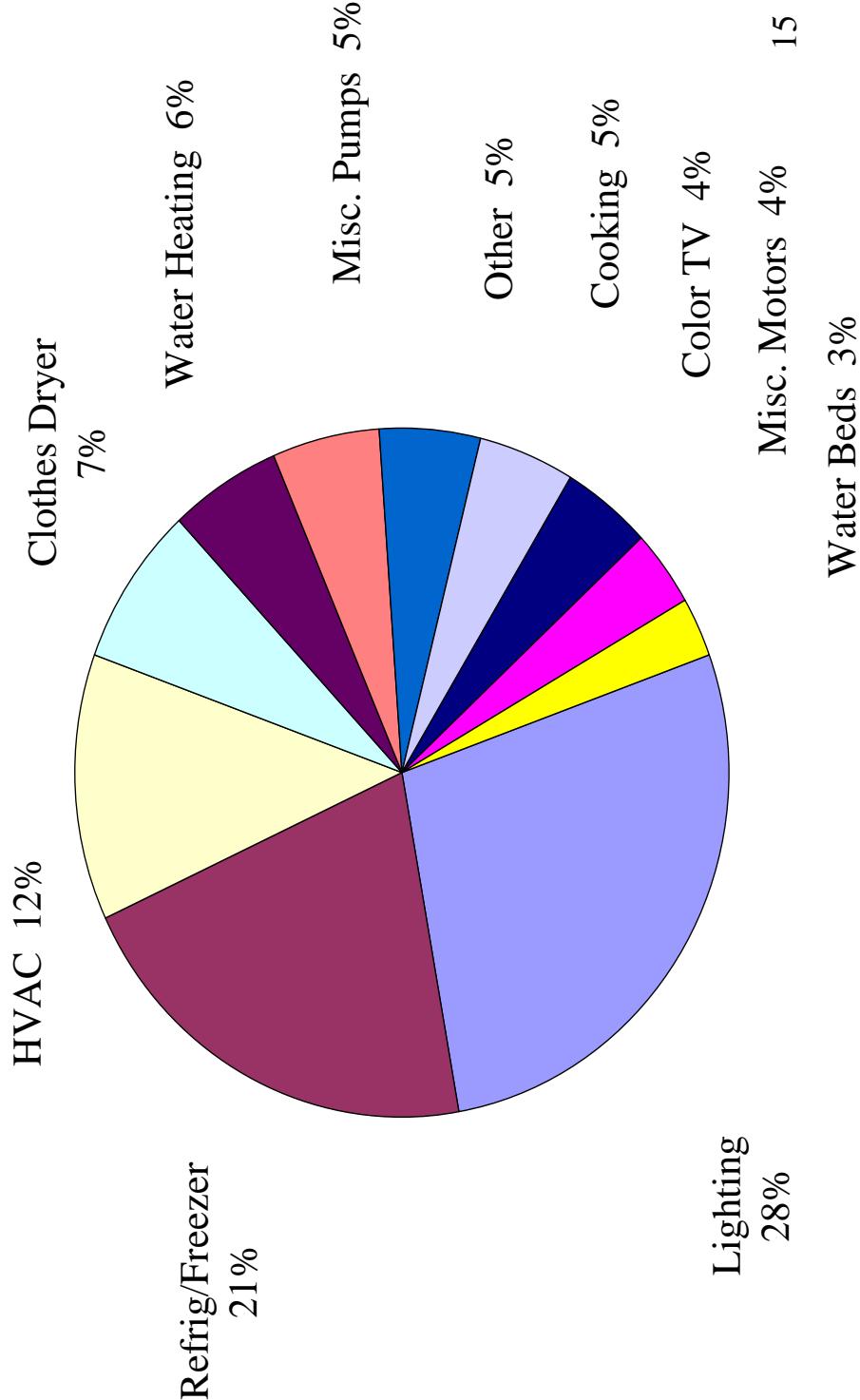


Portfolio Balance

Background - Energy Use (Residential)



Residential Annual Electricity Consumption (Year 2000 - 77,633 GWh)



15

Portfolio Balance

Background -Energy Use & Peak Demand

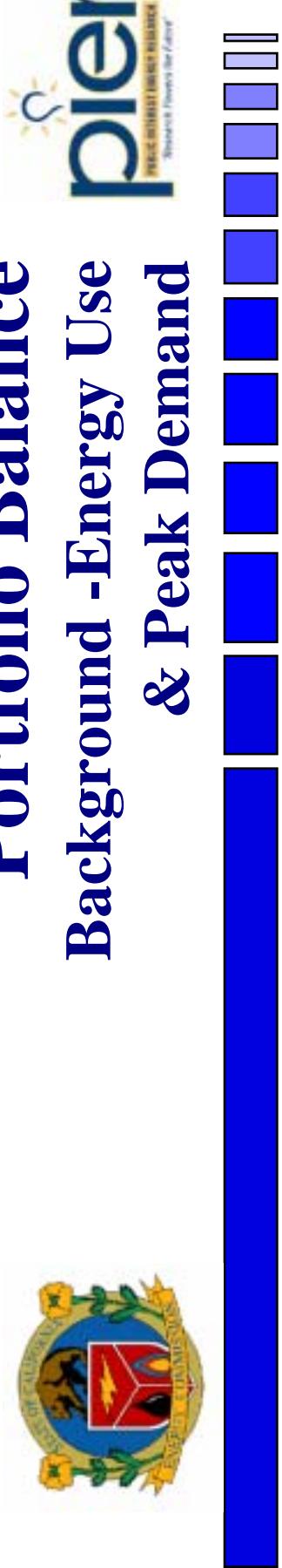


Table 1-1999 California Electricity Consumption and Peak Demand

Market Sector	1999 California Electricity Demand (MW)	1999 California Electricity Consumption (GWh/Year)
Commercial	18,670	89,512
Residential	17,221	75,411
Industrial	8,324	53,500
Agricultural	2,324	17,842
Transport & Street Lighting	2,918	15,335
Total	49,643	251,600

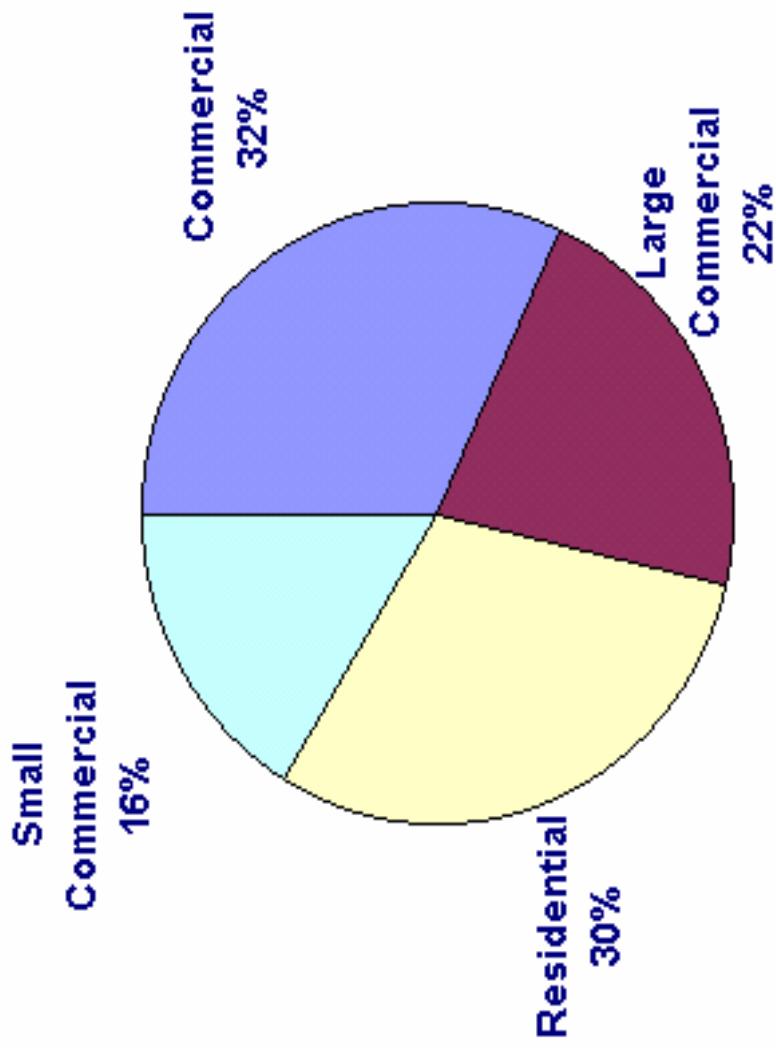


Portfolio Balance

Building Type



*Allocation of Committed Funds: Building Type
(\$41,443,032.00)*

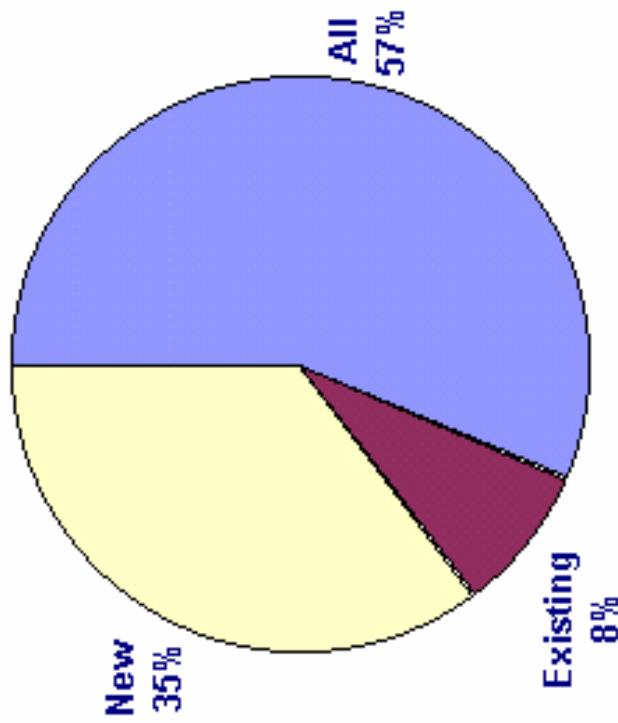




Portfolio Balance Building Vintage



*Allocation of Committed Funds: Building Vintage
(\$41,443,832.00)*

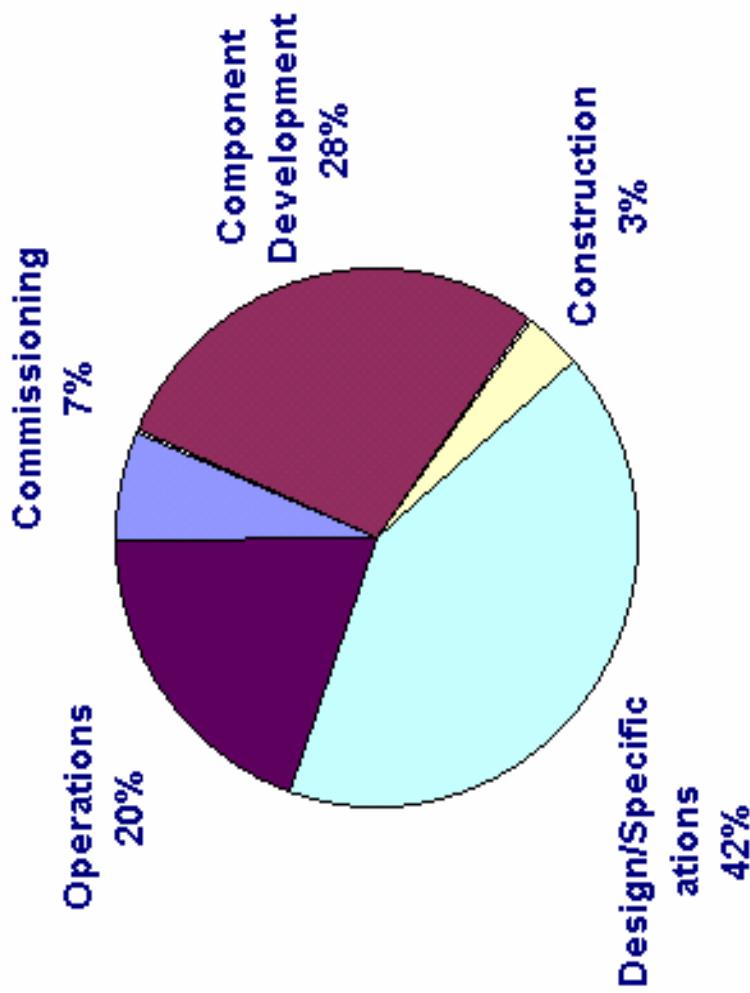




Portfolio Balance Building Life Cycle



Allocation of Committed Funds: Life Cycle
(\$41,443,832.00)





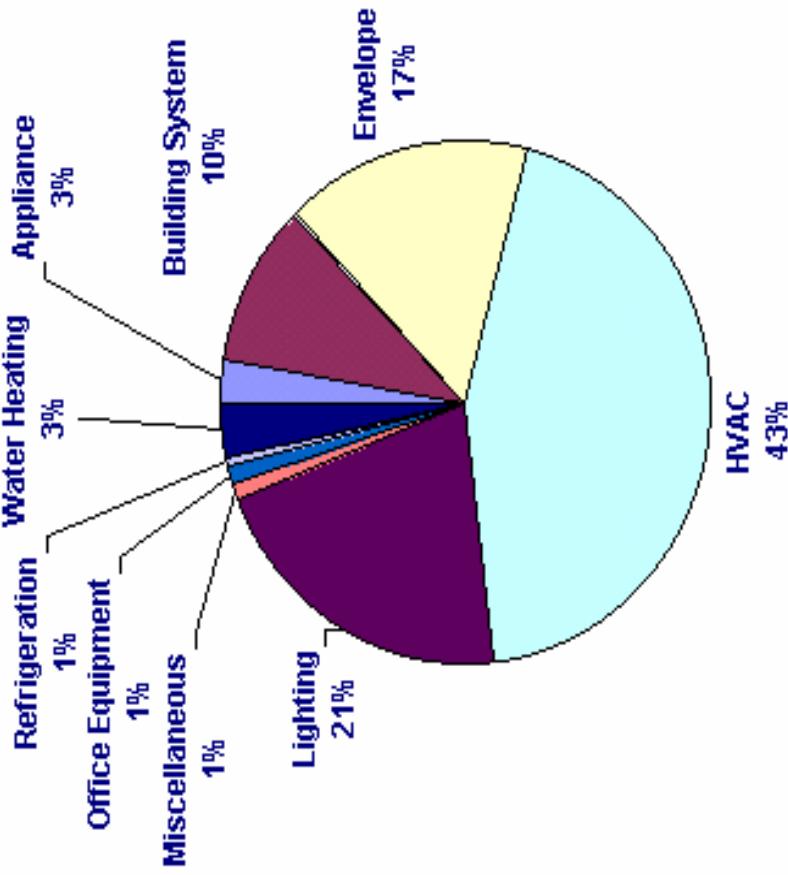
Portfolio Balance

End Uses



Allocation of Committed Funds: End Uses

(\$41,443,832.00)

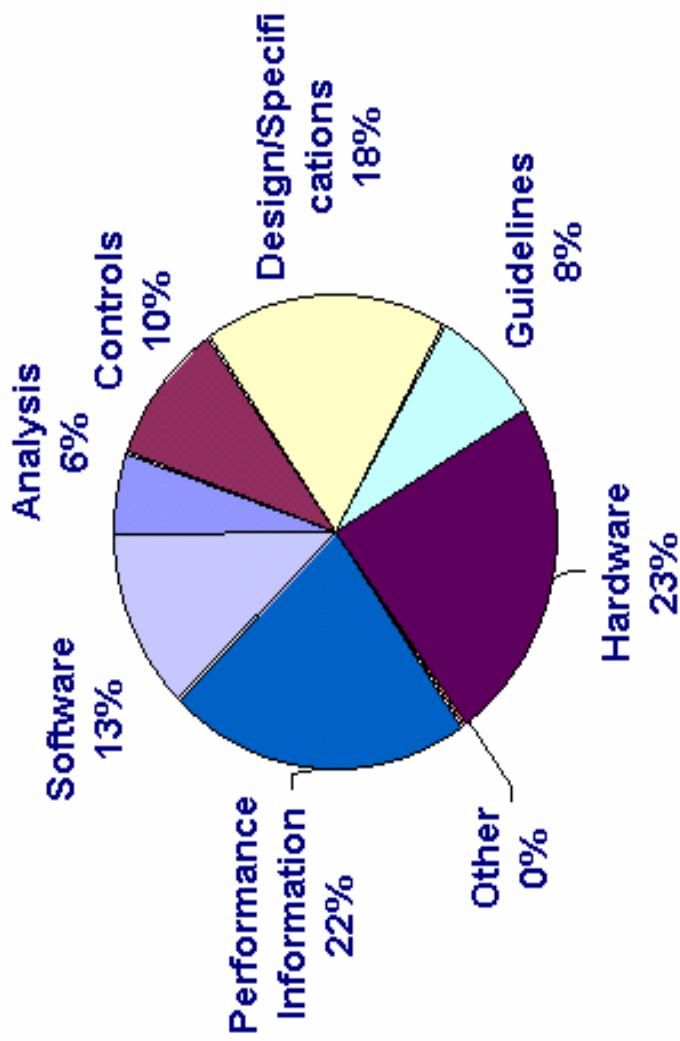




Portfolio Balance Research Products



*Allocation of Committed Funds: Research Product
(\$41,443,032.00)*

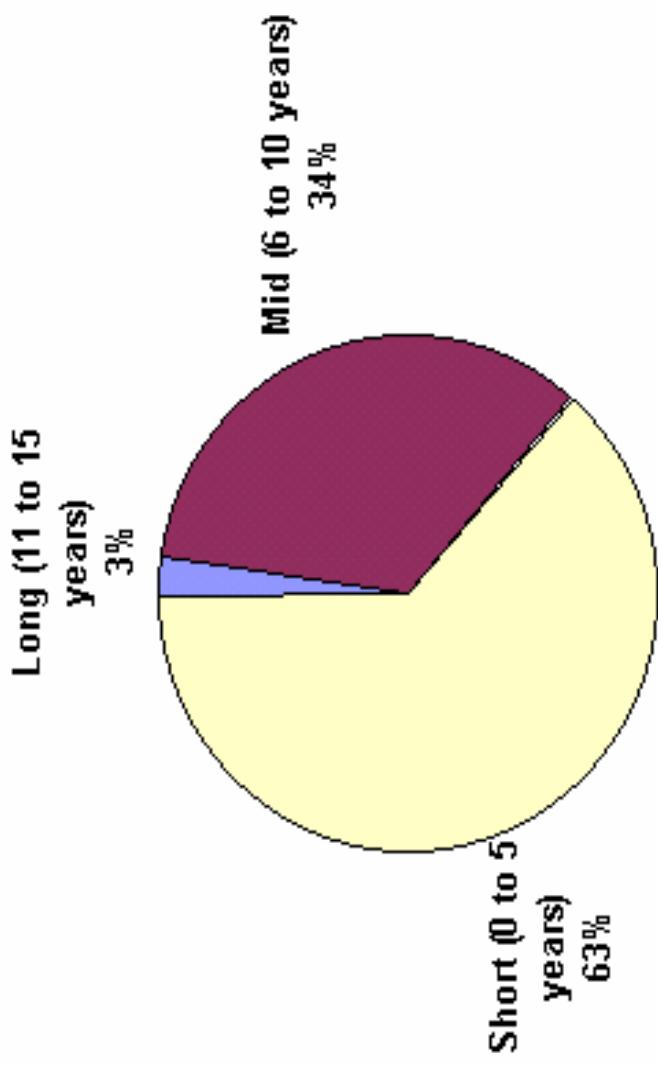




Portfolio Balance Time to Market



*Allocation of Committed Funds: Timeframe
(\$41,443,832.00)*





Implementation History



- Early 1998 - Transition solicitation
 - Outcome - 10 individual projects (\$6.4M total)
- Mid 1998 - PIER2 Solicitation
 - Outcome - 14 individual projects (\$10M total)
- 1999 - Programmatic solicitation
 - Outcome - 3 programmatic contracts (approx. 40 projects \$18M total)
- 2000 - Targeted programmatic solicitation
 - Outcome - 3 targeted contracts (\$3M total)
- 2001/2002 - Sole Source contracts/targeted staff initiated collaborations
- 2002 (planned) - Programmatic solicitation in the area of IAQ



Implementation

Competitive/Non-Competitive



■ Competitive

- Project level solicitations
- Programmatic solicitations

■ Non-Competitive

- Unsolicited proposals
- Staff solicited proposals
- Memberships



Implementation Funding By Solicitation Type



Funding by Solicitation Type

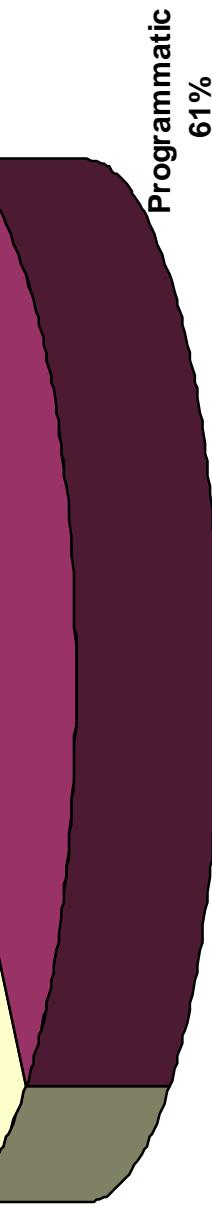
(\$41,443,032.00)

Unsolicited
Proposals
1%

Staff Solicited
Proposals
9%

Membership
3%

Project
26%





Implementation

Projects and Programmatic Contracts



■ Projects - Individual research efforts focussed on addressing goals/issues in a single area

- Pros
 - » Easy to manage
 - » Easy for individual researchers to participate
- Cons
 - » Researchers compete against each other in related work, often with some overlap in proposed work
 - » Staff resource intensive



Implementation

Projects and Programmatic Contracts



■ Programmatic - A set of related (linked) research projects combined under a single program umbrella

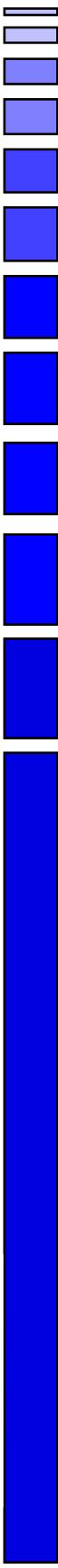
— Pros

- » Staff resource efficient
 - » Avoids duplication by bringing together diverse experts on a subject area when they would've submitted separate proposals
 - » Increase value of research by ensuring that related efforts are leveraging off of each other
 - » Increases technical management effectiveness because it is cost effective to have a program administer do the coordination and quality control
- #### — Cons
- » Tougher for individuals to participate



Implementation

Staff Initiated Collaborations

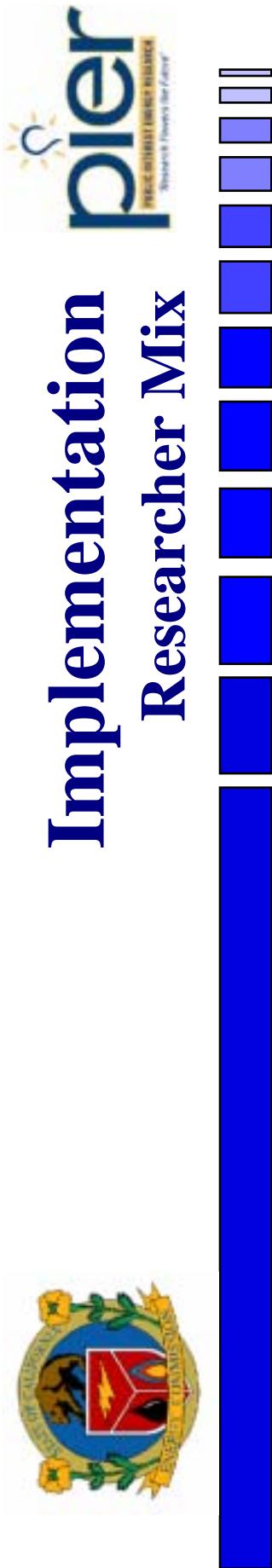


**Staff created collaborations when the need was apparent
or when an opportunity presented itself:**

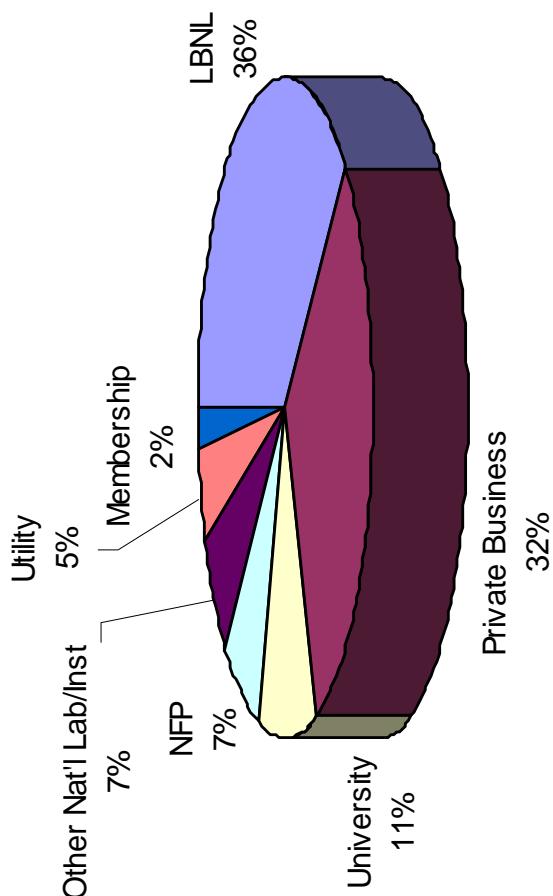
- Residential Framing Factors for Ca
 - *PIER Buildings/ASHRAE/CEC T-24*
- Commercial Buildings Cool Roof Monitoring
 - *PIER Buildings/CEC Peak Load Demand Program*
- Electrochromic Windows
 - *PIER Buildings/DOE/HUD/EPA*
- Development of Cool Colored Roofing Materials
 - *PIER Buildings/LBNL/ORNL*



Implementation Researcher Mix



Portfolio Funding By Researcher Type





Evaluation

Portfolio Analysis: Gaps/Opportunities



- As a process, the PIER Buildings area conducts a self assessment of the content and balance within the portfolio on a periodic basis to determine areas of future focus
 - Currently completing the second such analysis
- The first gap analysis followed the first round of programmatic funding and identified a gaps and opportunities in the residential sector.
 - Specific opportunities were identified in the areas of residential construction practices, low income housing, and residential water heating. This became the basis for the targeted solicitation.
- The second gap/opportunity analysis will contribute to focussing funding over the next 18 months.



Evaluation

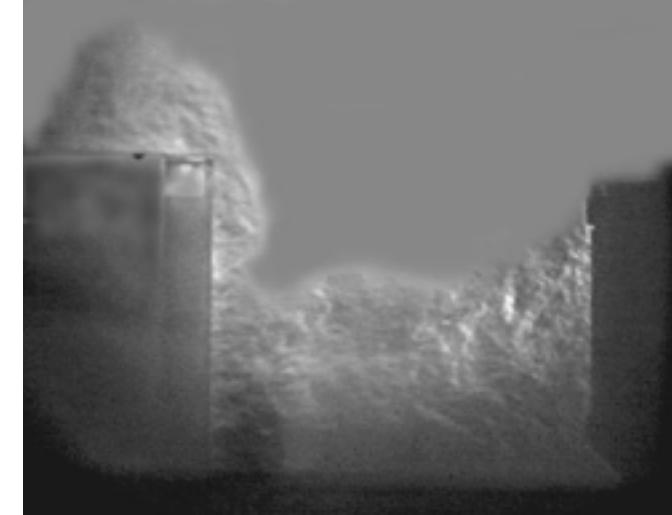
Portfolio Analysis: Gaps/Opportunities



- In addition to identification of gaps, the periodic portfolio analyses includes an evaluation of:
 - Portfolio balance
 - Portfolio content
 - Usefulness of products
 - Appropriate mix of researchers?
 - Market impacts (qualitative)
 - Market impacts (quantitative)
 - Ways to improve processes



Commercial Kitchen Ventilation Overview



- PG&E Food Service Technology Center project from 1998 PIER solicitation
- \$276k budget
- Project focus
 - Test alternative equipment configurations to identify the most energy-efficient design alternatives for providing makeup air

“Schlieren” photo showing exhaust hood spilling effluent



Commercial Kitchen Ventilation

Problems/Opportunities



- Kitchen ventilation uses a lot of energy
 - Kitchens have high exhaust rates to remove cooking effluent, combustion gases, heat, and odors
 - Kitchen ventilation is 11% of restaurant energy use and 40% of restaurant HVAC use
- Typical commercial kitchen ventilation systems are not energy-efficient
 - Design emphasis on individual pieces of equipment with little focus on HVAC interaction
 - Case study demonstrated 60% reduction in make-up air!



Commercial Kitchen Ventilation

Research Scope



- Equipment configurations tested:

- 3 hood styles
 - 5 MUA configurations
 - Medium/heavy-duty appliance classifications
 - With and without cross drafts, side panels
 - 214 test combinations!

- Schlieren visualization technology used to verify effluent capture and containment at different exhaust levels



Commercial Kitchen Ventilation

Schlieren Methodology





Commercial Kitchen Ventilation

Key Findings



- Best make-up air strategies in preferred order:

- *Transfer air from the dining room or other areas*
 - *Use displacement ventilation in kitchen*
 - *Use backwall (rear-discharge) exhaust hoods*

- Design strategies to avoid:

- *Short-circuit hoods*
 - *Air-curtain hoods*
 - *4-way ceiling diffusers located near hoods*



Commercial Kitchen Ventilation Commercialization Activities



- Researchers influenced exhaust hood design/selection in many organizations, including Burger King, MacDonalds, Denny's, and Ventmaster
- Demonstration planned with Denny's and SDG&E
- Outreach conducted through multiple venues
 - *Design Guidelines published for design practitioners*
 - *Statewide seminars at PG&E, SCE, So Cal Gas*
 - *National conference papers and presentations*
 - *Magazine articles*



The Berkeley Lamp and California Kitchen Lighting

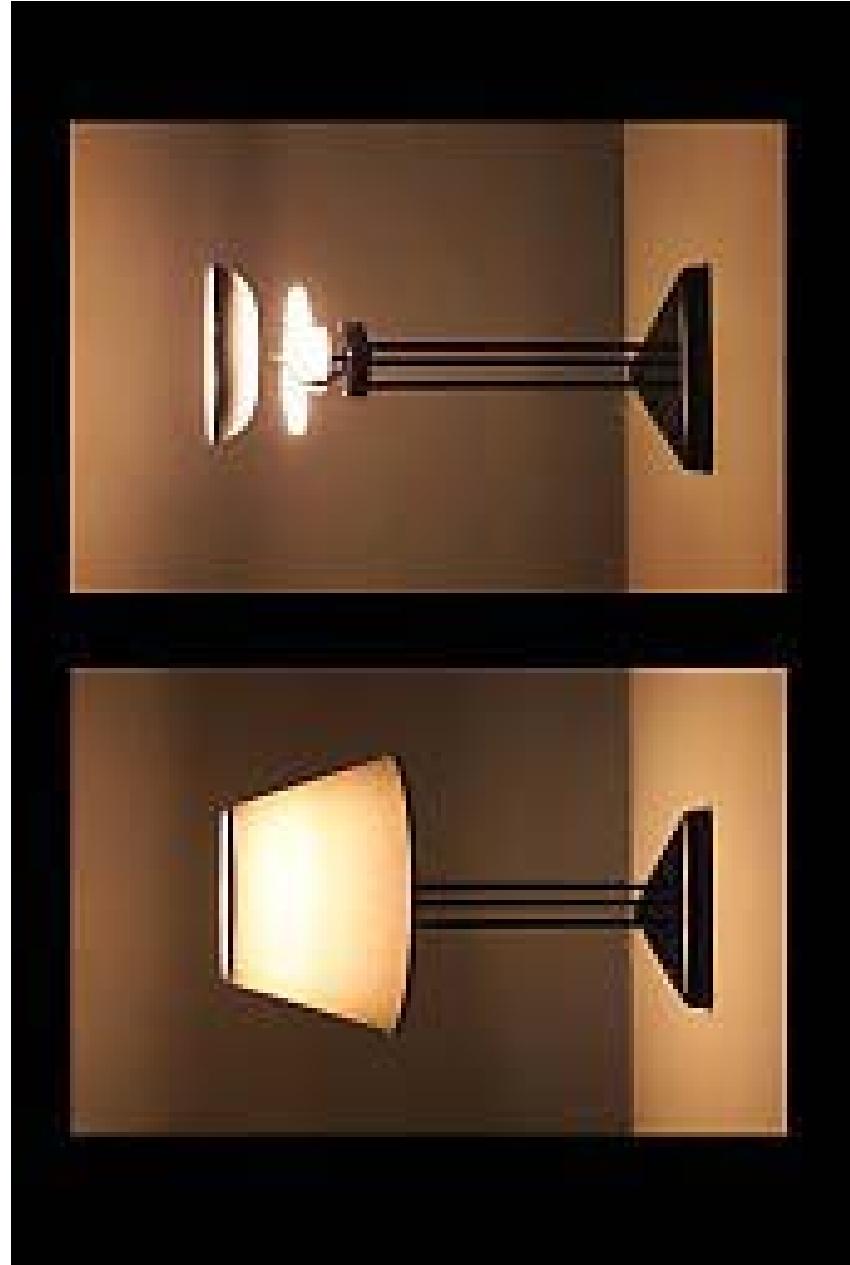
Presented by Erik Page
Lawrence Berkeley National Lab Scientist



The Berkeley Lamp



Laboratory-Utility-State Partnership



The Problem with Existing Office Lighting



- **Poor photometric performance for modern office needs**

- Overhead lighting provides significant screen glare and is significantly limited on controllability



- **Needlessly energy intensive**

- Overhead lighting used to light all areas uniformly regardless of need or occupancy



The Berkeley Lamp



• Increased lighting quality

- low glare-computer
- unique control features
- lots of light
- *energy savings*





Controllable Lighting



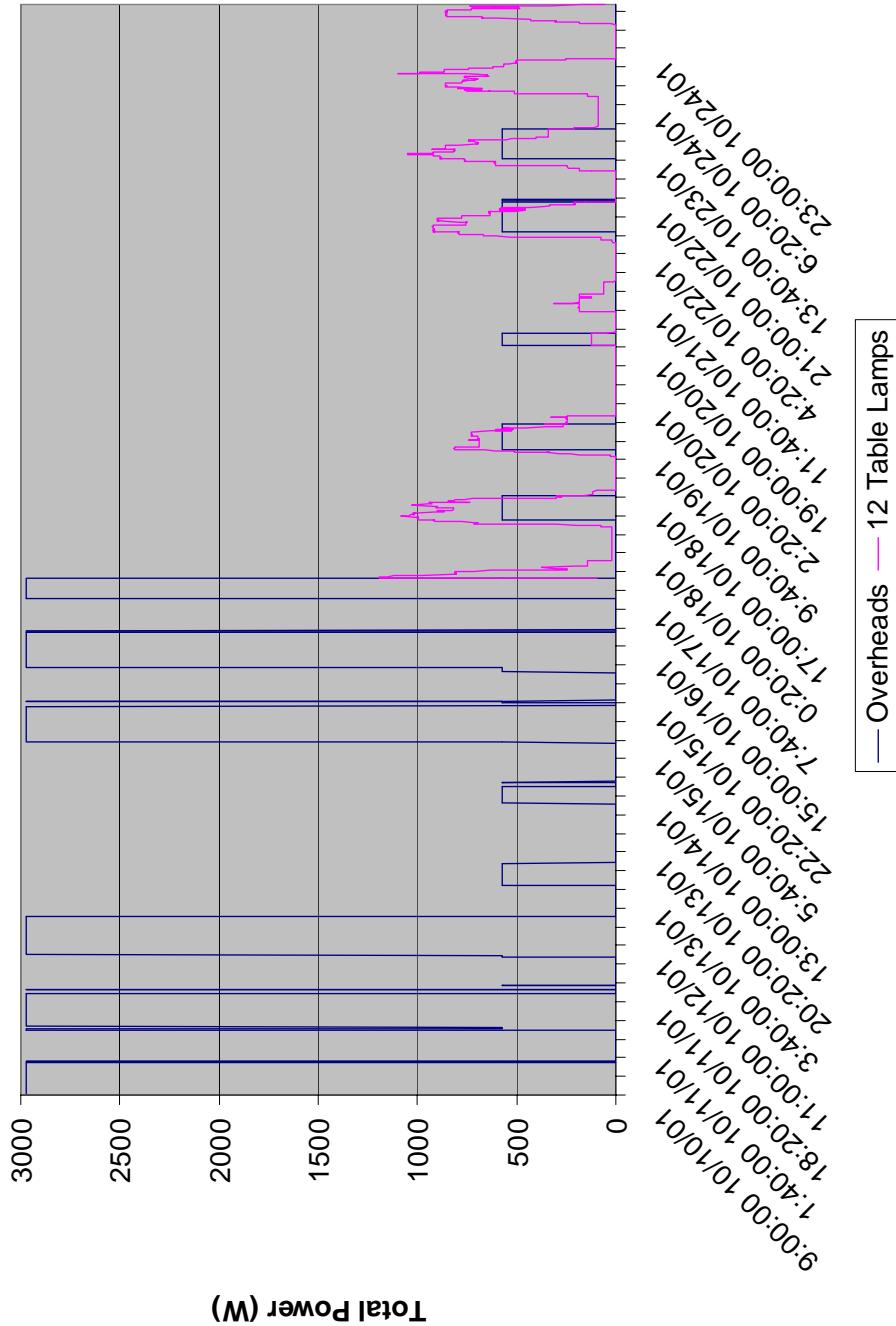
The indirect light mode is ideal
for computer applications

The task light provides ample
light for reading and writing tasks

Energy Savings

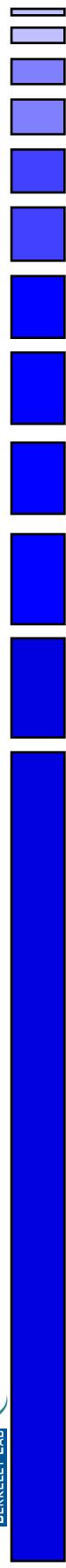


Switching Over to Berkeley Lamps





Current California Demonstrations



- City of Berkeley
- CEC
- Lawrence Berkeley Lab
- SMUD
- SCE
- U.S Coast Guard
- Hickam Air Force Base
- UC Berkeley
- UCOP
- VA hospital (FEMP)
- DOE HQ (Forestal)
- Sacramento DoubleTree



Commercialization

A Partnership with Utilities

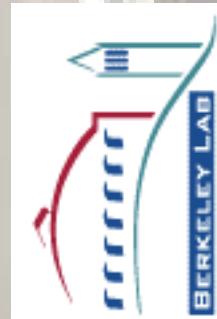
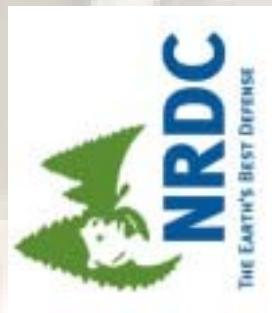
- Presented to CEC's Emerging Technology Committee
 - Utilities agreed to partner to bring product to market
 - Develop specification and National RFQ
 - Utility purchase and demonstration
- Now commercially available



Energy Efficient Downlights for California Kitchens

Lawrence Berkeley National Laboratory

Funded by the
California Energy Commission
Public Interest Energy Research Program





The Problem with Existing Kitchen Lighting



- Large load, long burn hours
 - An average of 6, 75 W incandescent downlights are installed in today's Title 24 compliant new homes
- Downlight installation labor intensive and error prone
- Existing CFL downlights poor quality and expensive
- Electronic ballasts have thermal issues in insulated ceilings

Solution:

The Kitchen Lighting System



- **System Approach**

- integrated design for performance and cost savings

- **Building Friendly**

- explicitly designed to make installation less labor intensive and less error prone

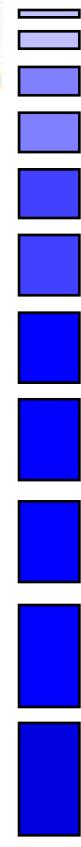
- **Multi-Lamp Ballast**

- system built around the use of multiple, 2 lamp ballasts for low cost (one ballast per two downlights), scalable and field proven ballast options

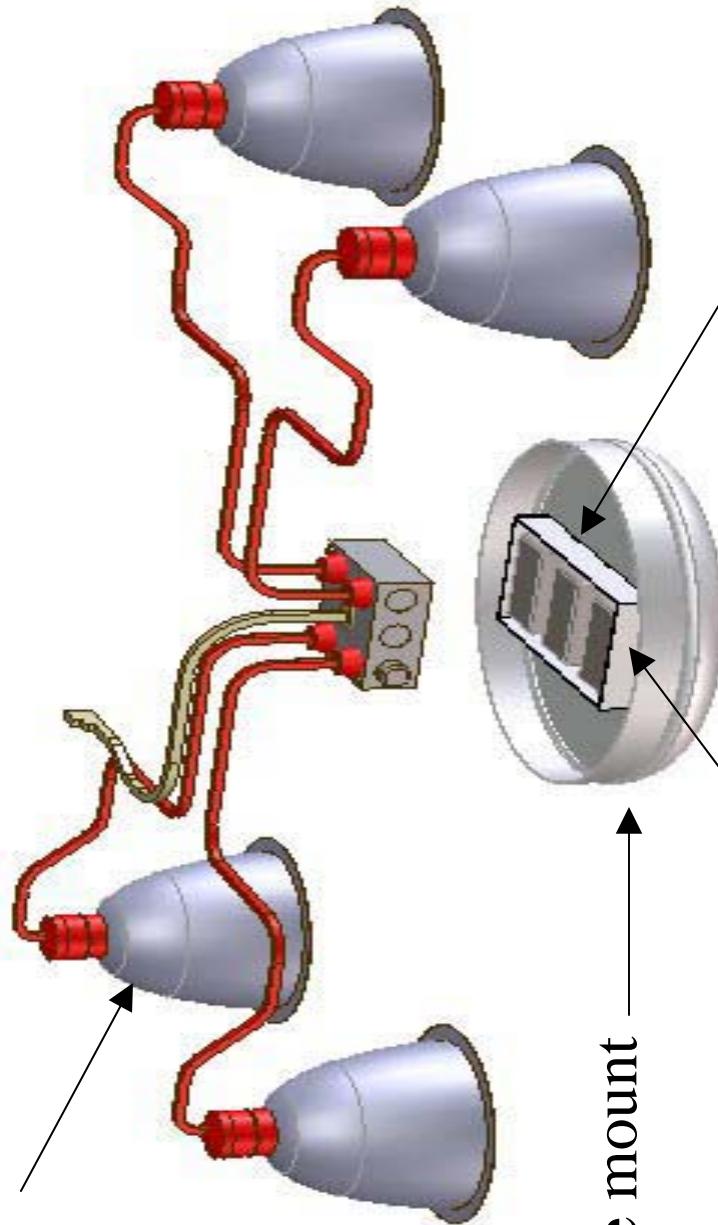
- **Remote room-side placement of ballasts**

- ballasts placed in a housing on the room-side of the ceiling for enhanced thermal performance and ease of access for maintenance

Concept Anatomy



Optical heads



Surface mount

Single ballasts for
surface mount

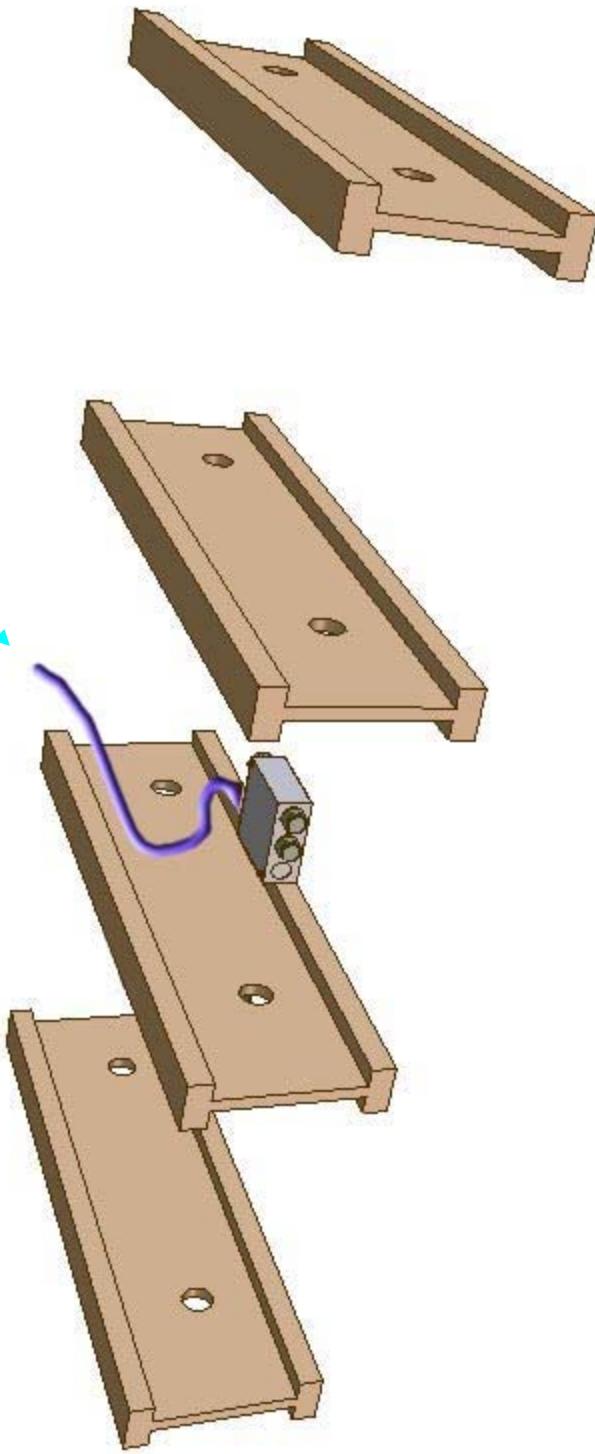
Two ballasts for four
optical heads



pier

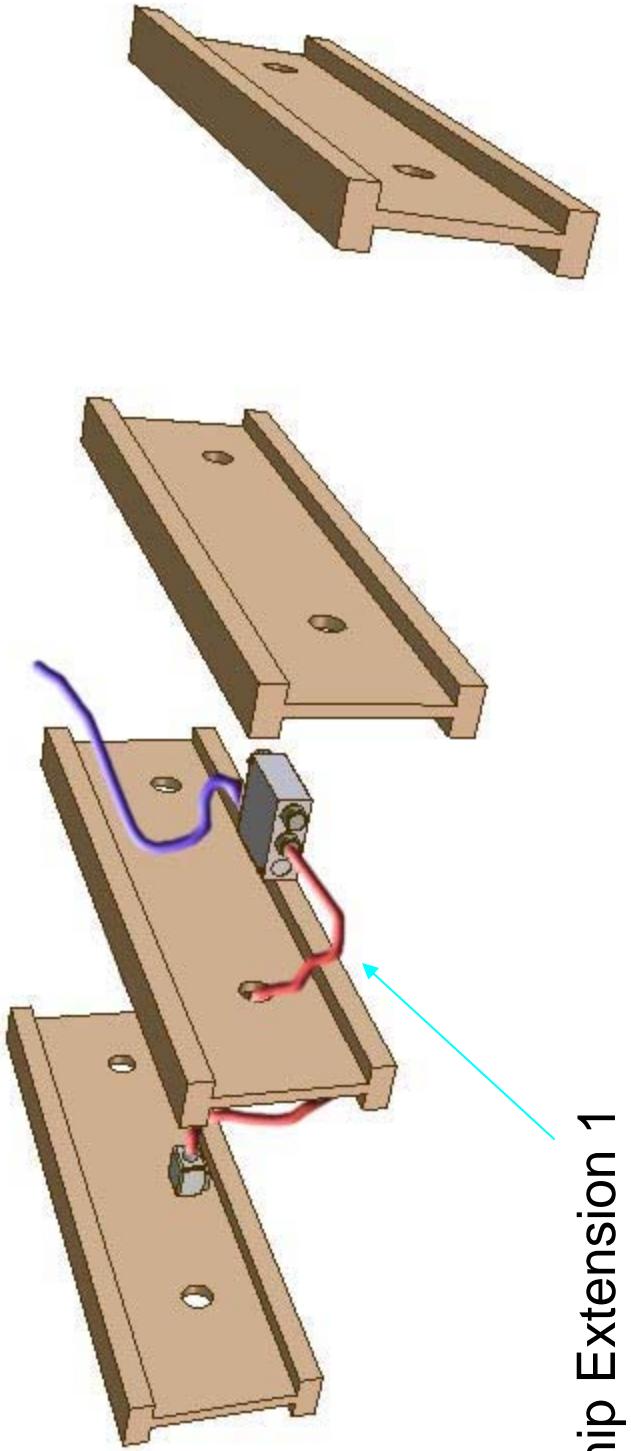
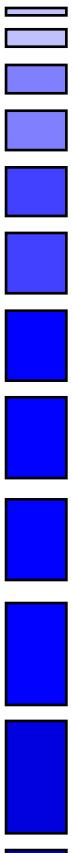
Install 110 V Service and J-Box

110 V service





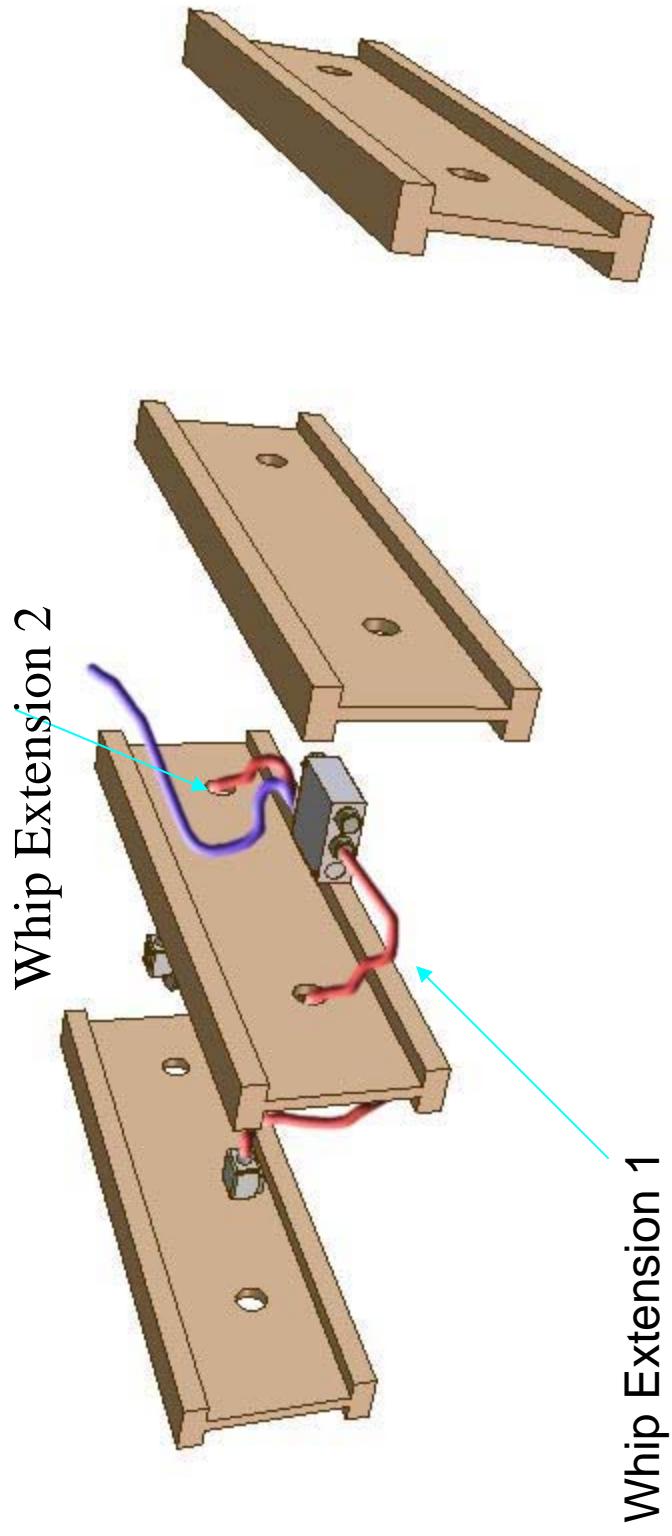
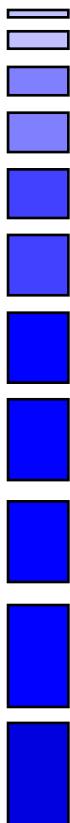
Install 'Whip' Extensions



Whip Extension 1

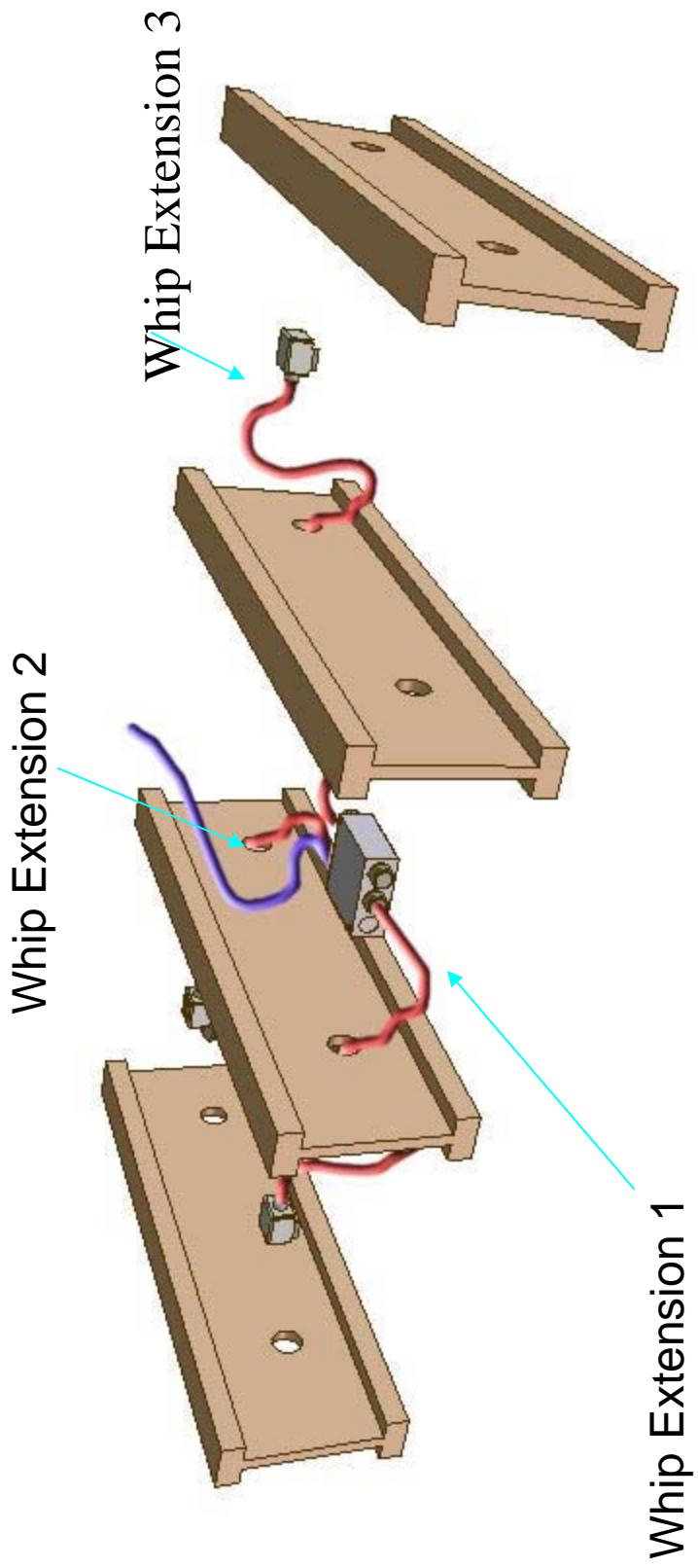


Install 'Whip' Extensions

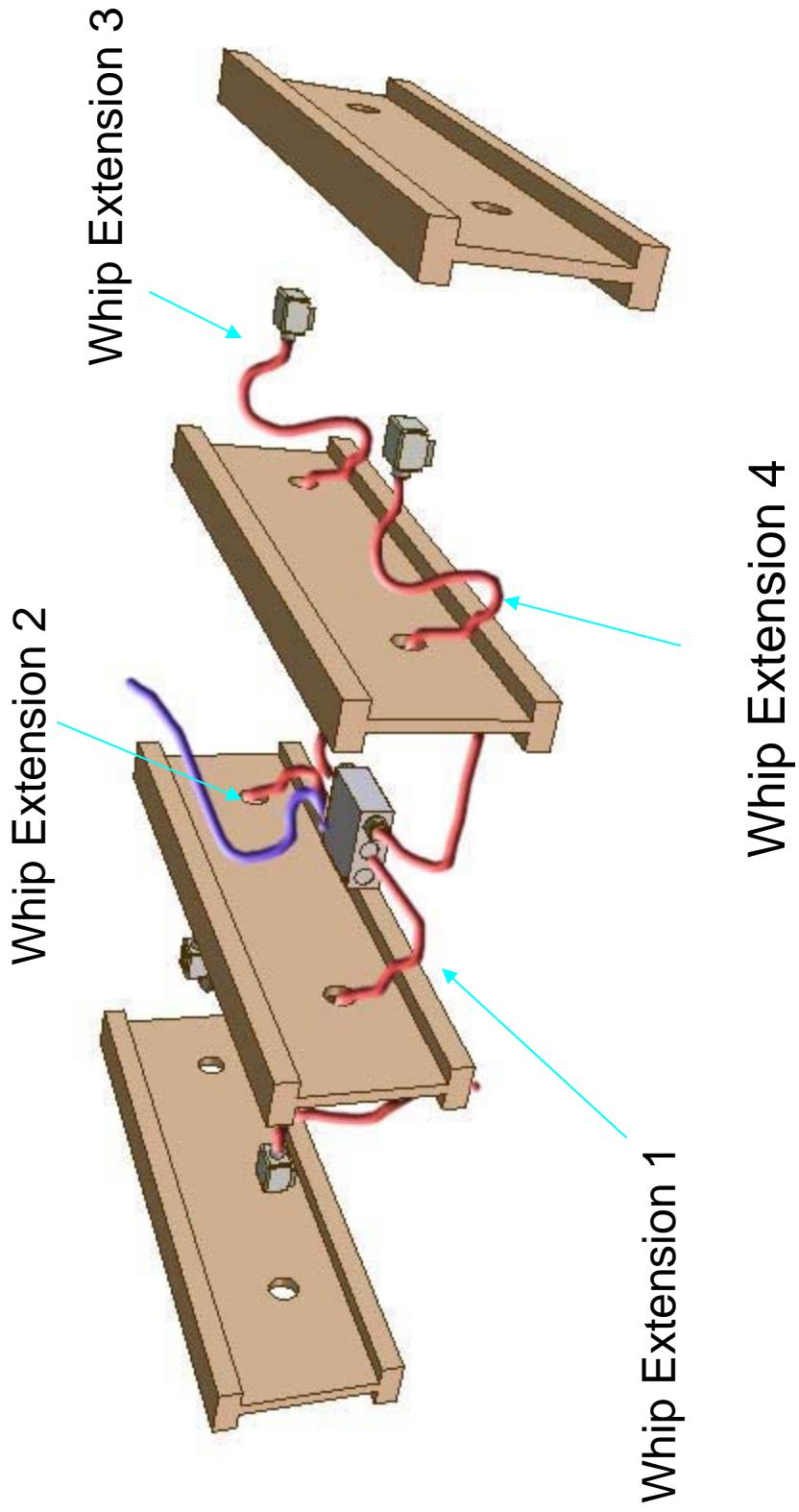




Install 'Whip' Extensions

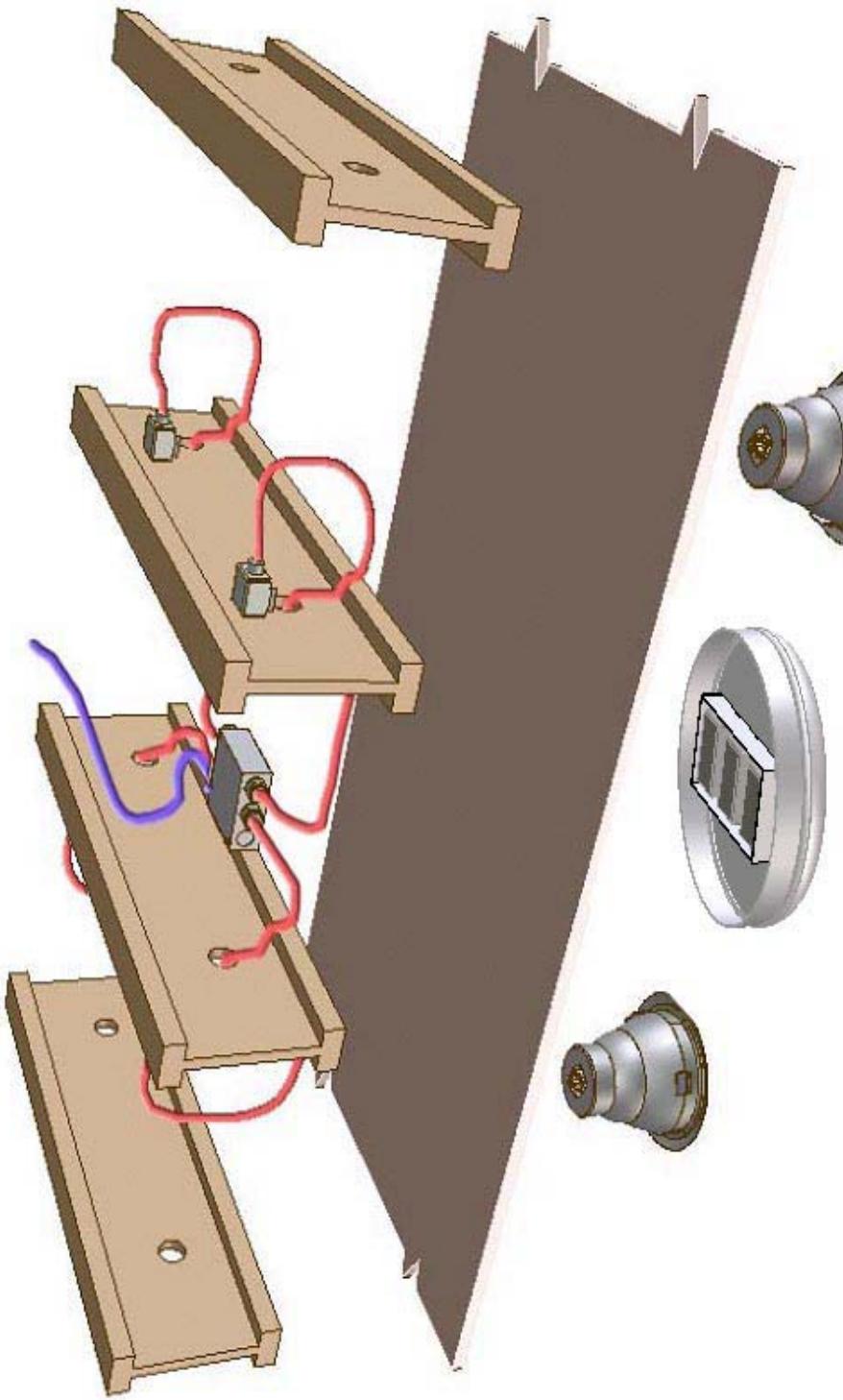


Install 'Whip' Extensions

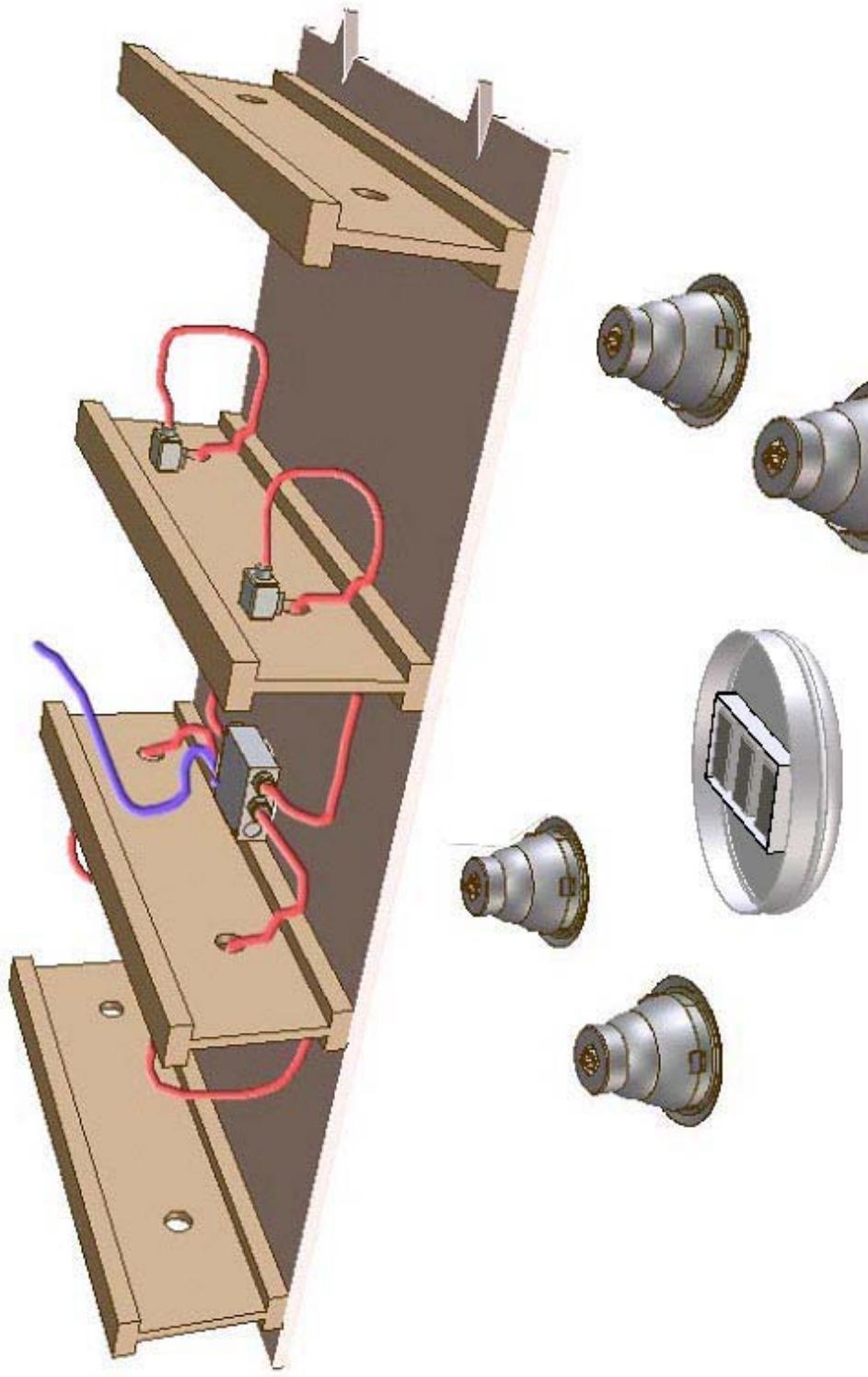




Install Drywall Ceiling

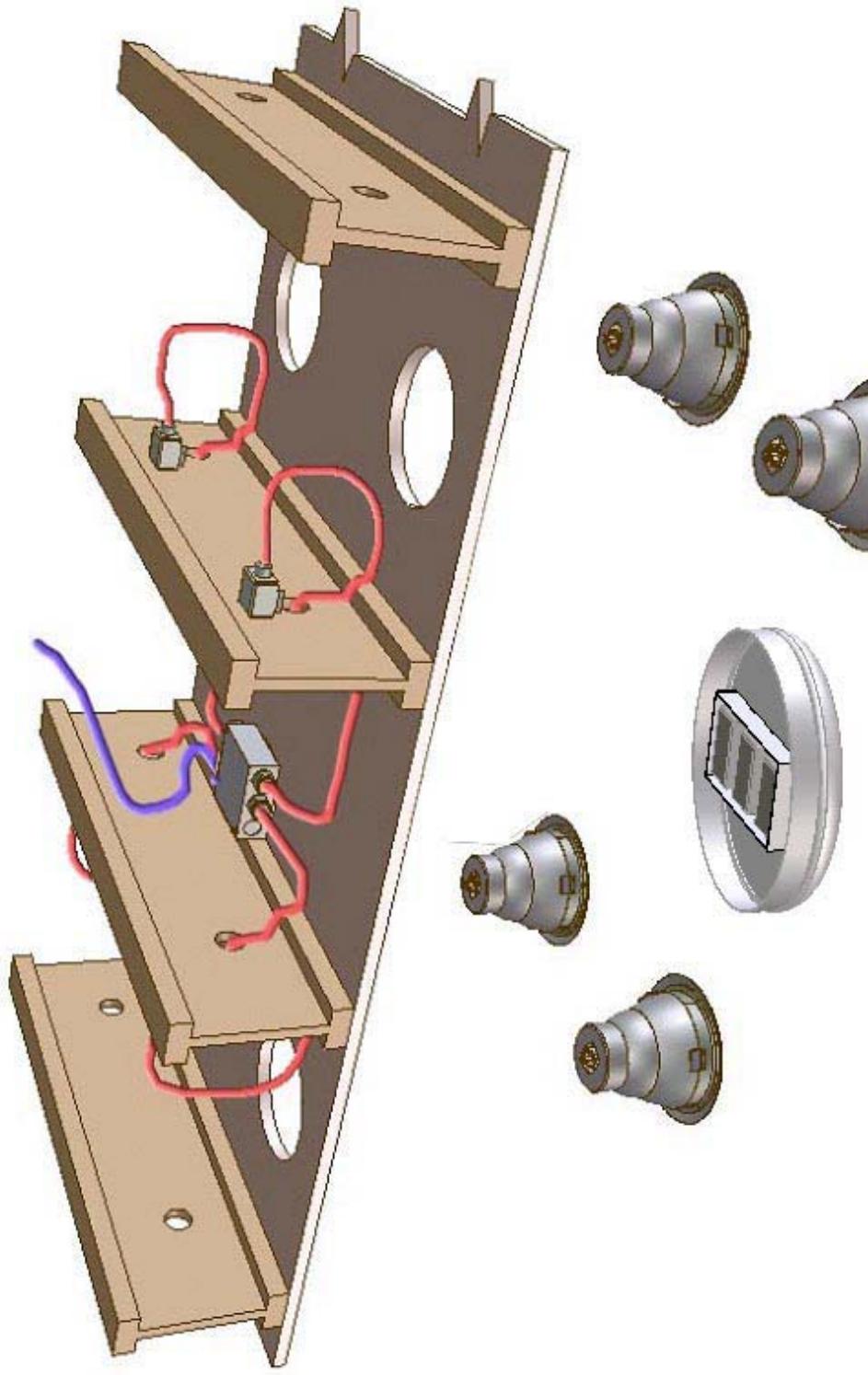
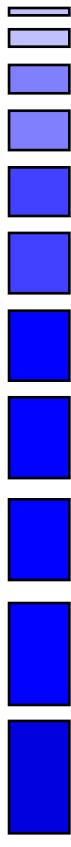


Install Drywall Ceiling



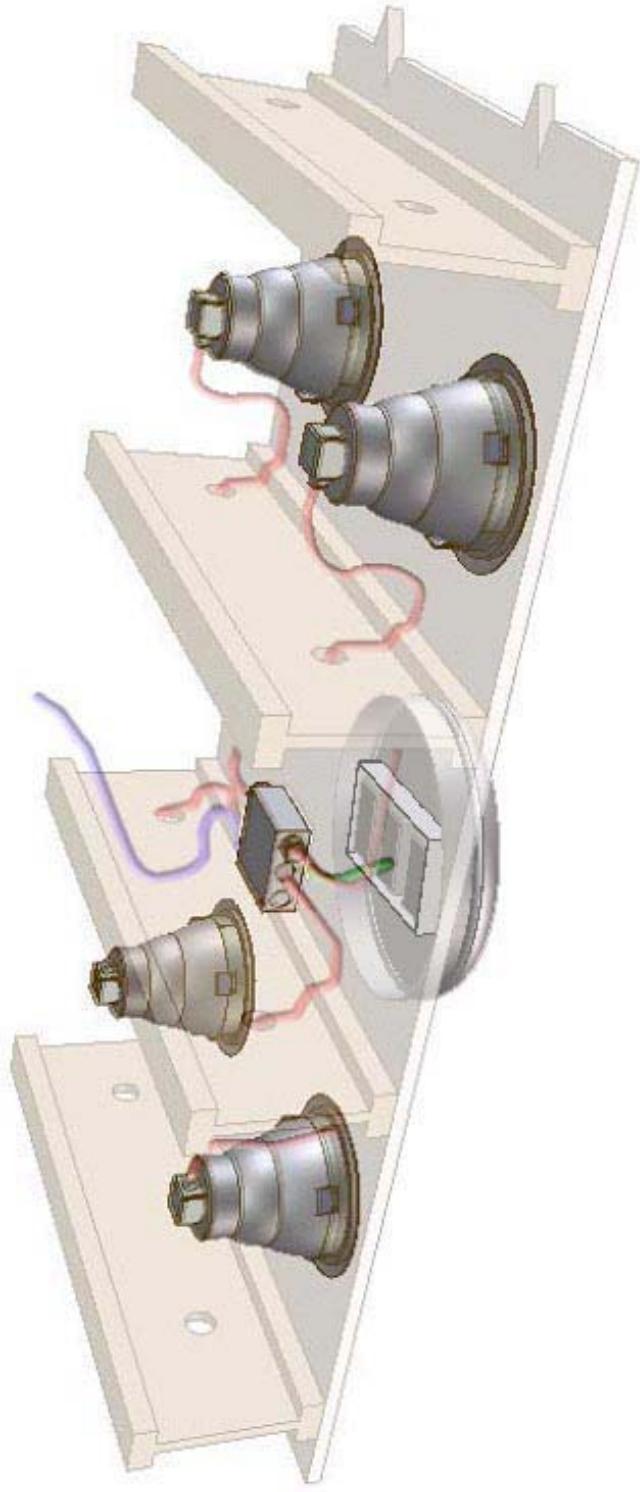
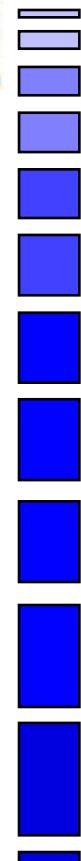


Locate and Cut Holes in Ceiling



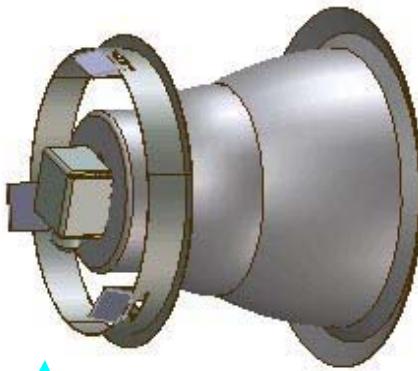
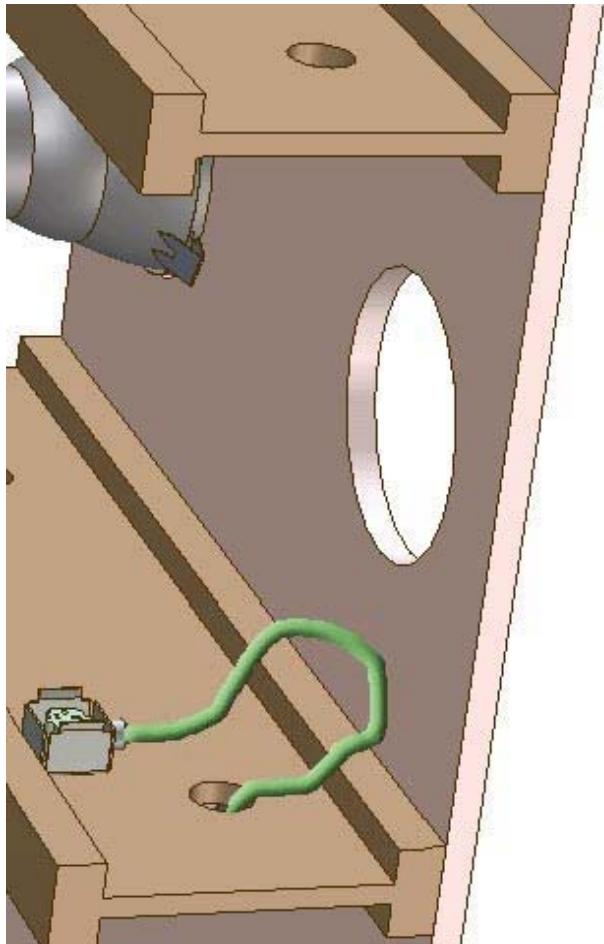
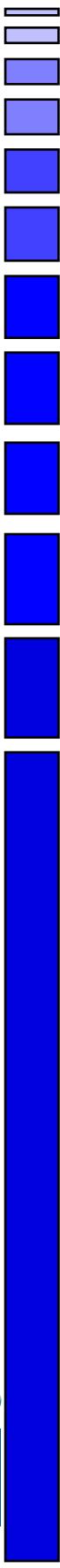


Wire and Hang the Central Fixture





Install Optical Head Retention Ring

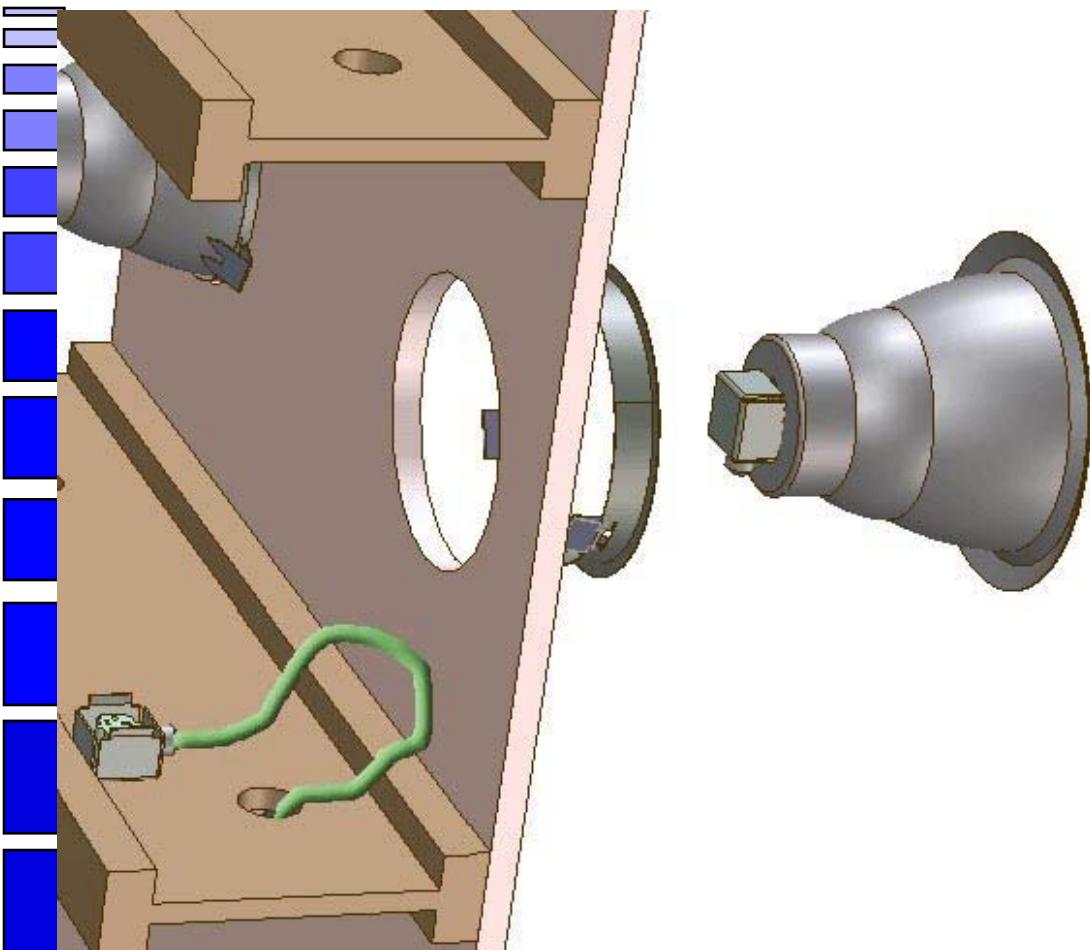


Retention Ring



BERKELEY LAB

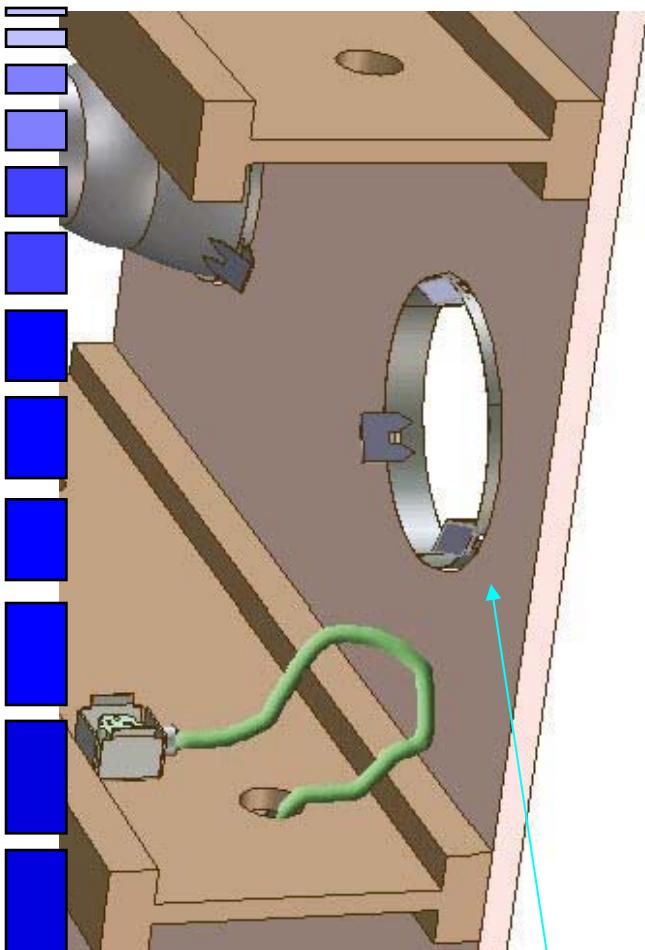
Install Optical Head Retention Ring



Retention Ring



Install Optical Head Retention Ring



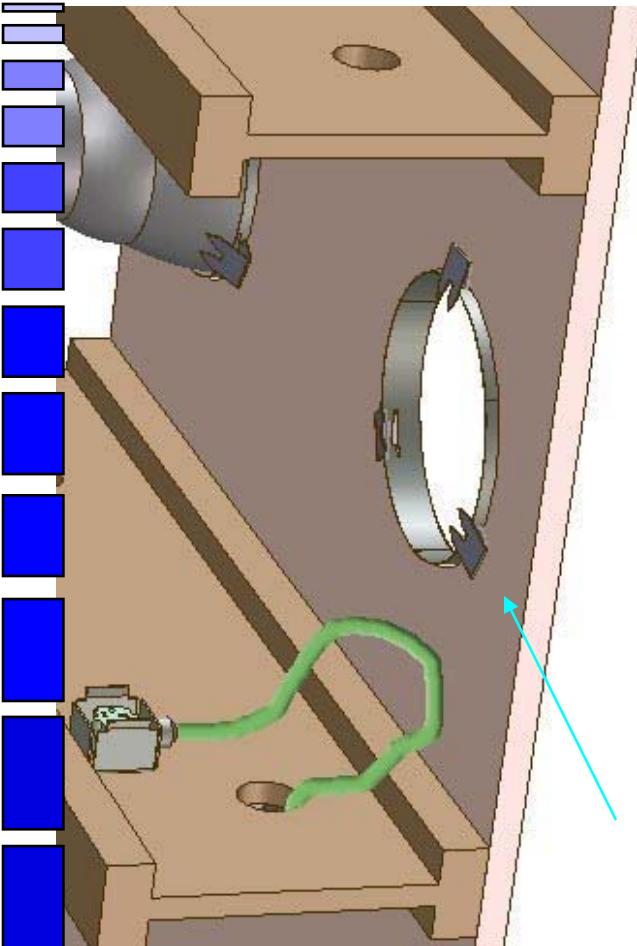
Retention Ring





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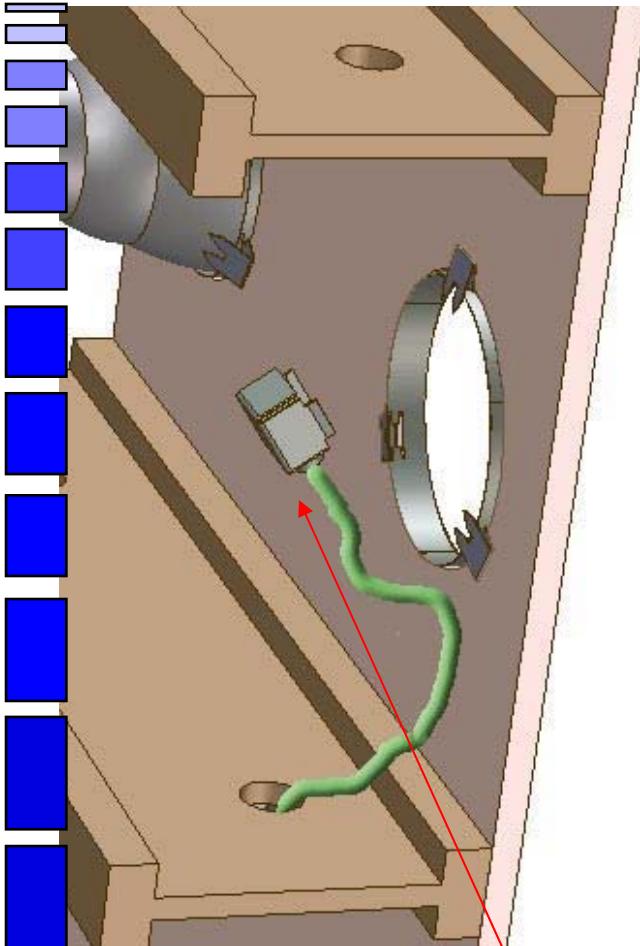
Flip Clip to Engage Drywall



Retention Ring is loosely held in place



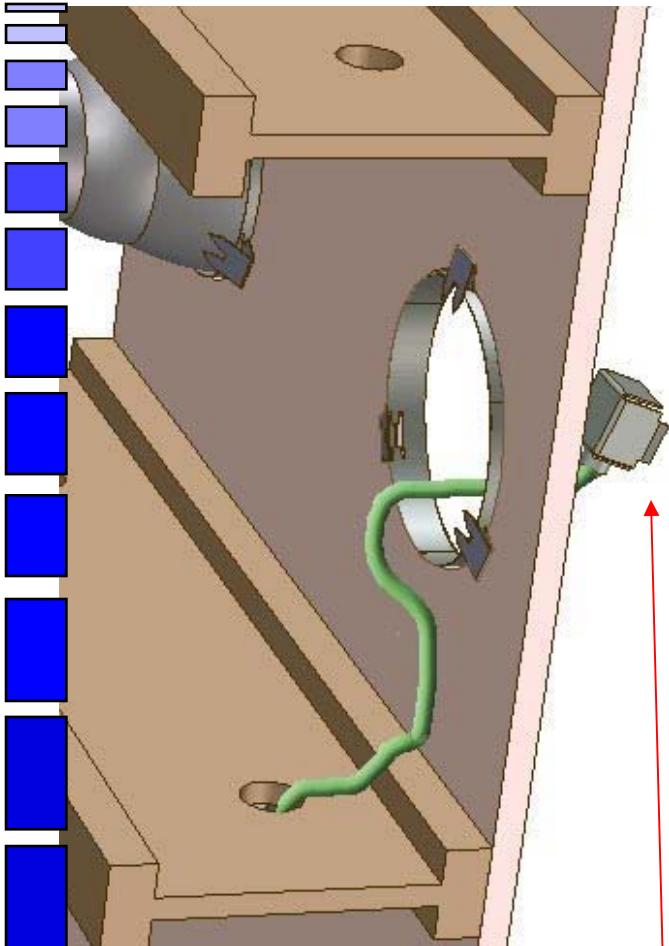
Reach Through



Pull down plug assembly



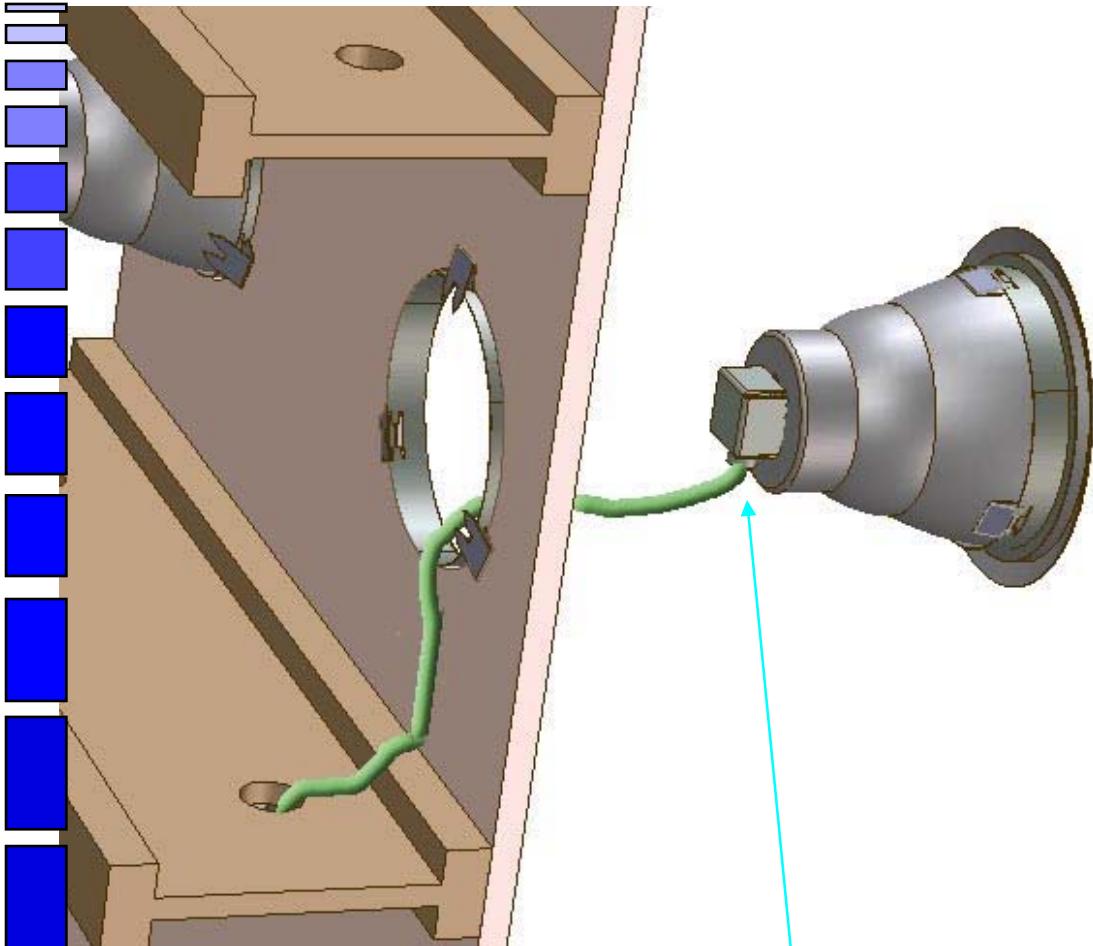
Reach Through



Pull down plug assembly

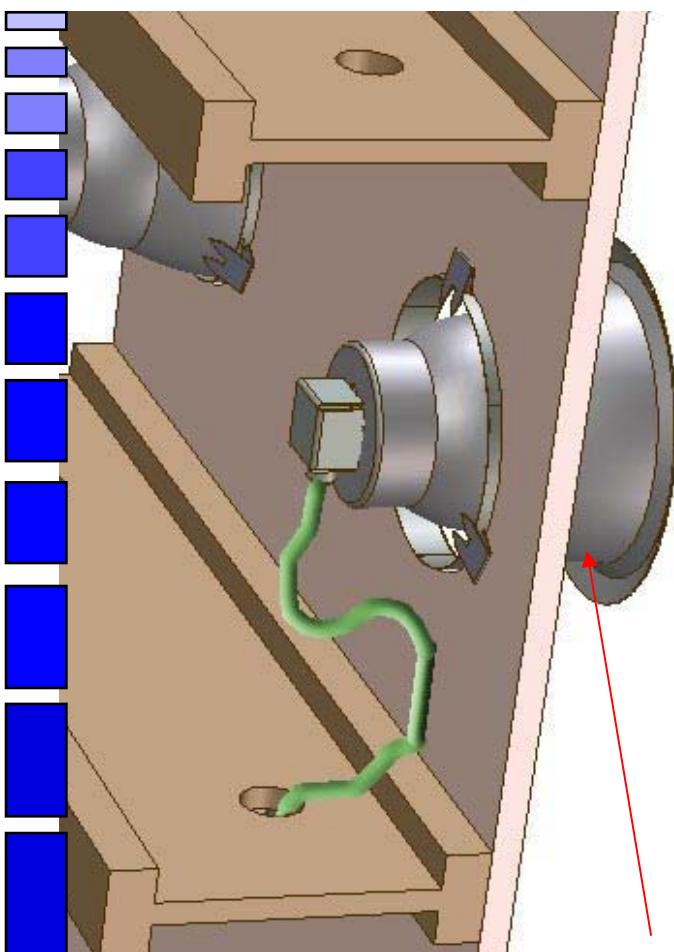


Plug in the Fixture



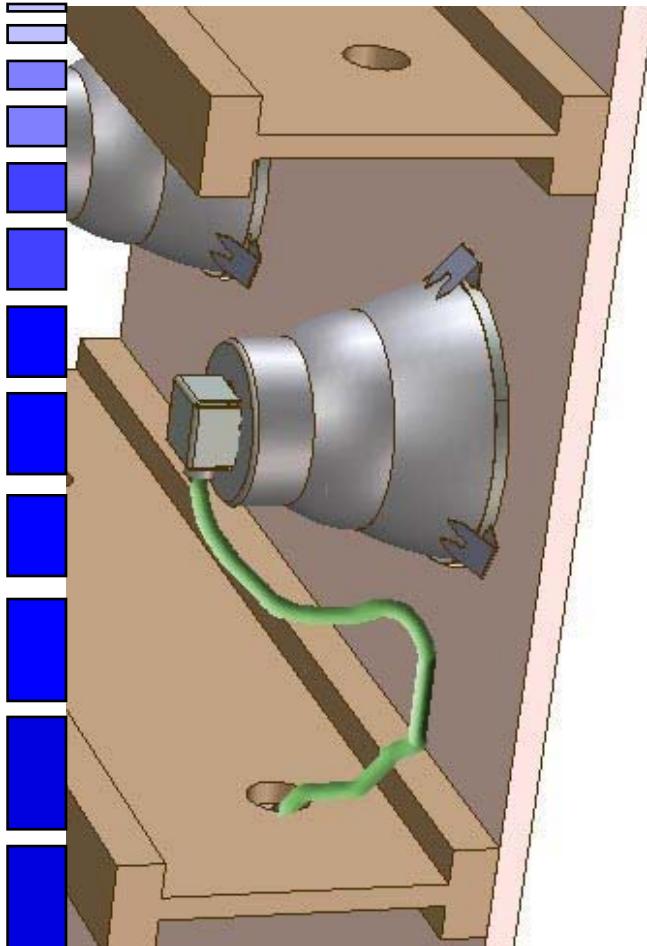
Plug in the Fixture

Insert Fixture



Insert fixture into retention ring

Insert Fixture



Fixture is locked into place



Lighting Research Program Overview



- \$5.2 million budget
- Two-year scope, starting October 2002
- Project focus
 - Short/mid-term results
 - Applications oriented
 - Numerous commercialization links...



Building on previous success



Lighting Research Program Problems/Opportunities



- **California lighting energy use is high**
 - 23% of California electricity usage
 - 28% of residential sector usage
 - 34% of commercial sector usage
 - ... plus ~5% for air conditioning load
- **Electric demand high too**
 - ... 40–50% of commercial sector load
- **Significant energy savings potential**
 - ... up to 50% in the next 10–20 years



Lighting Research Program

Contract Approach



- ID research needs nationwide
 - ... talked to ~80 *industry leaders*
- Select project opportunities
 - ... focus on *California needs*
- ID sole-source research team
 - ... *Prime contractor*
 - ... *Subcontractors (nearly all)*





Lighting Research Program

Contract Structure



Five Technical Elements

- Advanced Technologies
- Demand Responsive Systems
- Advanced Lighting Systems
- Performance Metrics, Codes, and Standards
- Market Connection
- ... *Plus Administration*





Lighting Research Program pier

Commercialization Focus



Working with Manufacturers & Building Owners

- Finelite (*Union City*)... *luminaires*
 - WattStopper (*San Jose*) *control hardware & protocols*
 - Cree Lighting (*Santa Barbara*)... *LED sources*
 - Lithonia (*Georgia*)... *residential kitchen lighting*
 - Marriott Hotels... *bathroom lighting demo (Calif)*
 - IFMA... *stairwell lighting demo (Calif)*
- ... *and more!*



Lighting Research Program pier Expected Products



Hardware

- **Hotel bathroom luminaire**

- ... *LED night light and occupancy sensor integrated*
- ... *retrofit and new/renovation versions*

- **Classroom lighting system**

- ... *“system in a box” (luminaire PLUS controls)*
- ... *designed for daylighting*

- **Residential table lamps**

- ... *Energy Star rated using compact fluorescents*
- ... *getting manufacturers over “chicken and egg” syndrome*



Lighting Research Program

Expected Products



Hardware (cont.)

- **Demand limiting ballast**

- ... 30–60% peak reduction
- ... new & retrofit versions

- **LED porch light**

- ... LED w/photosensor; CFL w/occupancy sensor
- ... longer lamp life provides improved security

- **LED low-profile fixture**

- ... unique lamp characteristics provide focus/size benefits
- ... under-shelf & retail display applications



Lighting Research Program Expected Products



Non-Hardware

- Enhanced ballast control standard (DALI)
- Characterize bi-level stairwell fixture performance
- Determine opportunity for low-glare outdoor fixture retrofit
- Evaluate electronic ballasts for high-intensity discharge (HID) lamps... performance, controls



Lighting Research Program Expected Products



Market Connections

- Links beyond typical program/project advisors
 - Coordinated outreach effort
 - “Virtual” product review panel (*e.g., building owners, code officials*)
 - Alliance building (*e.g., IFMA, BOMA, IES*)
- Commercialization support
- Lighting standards connection



Lighting Research Program Summary



- Contract type... *sole-source, programmatic*
- Project selection... *national networking*
- Program focus... *short-term results, products*
- Market connections... *integration stronger than ever*

Look for our new products!



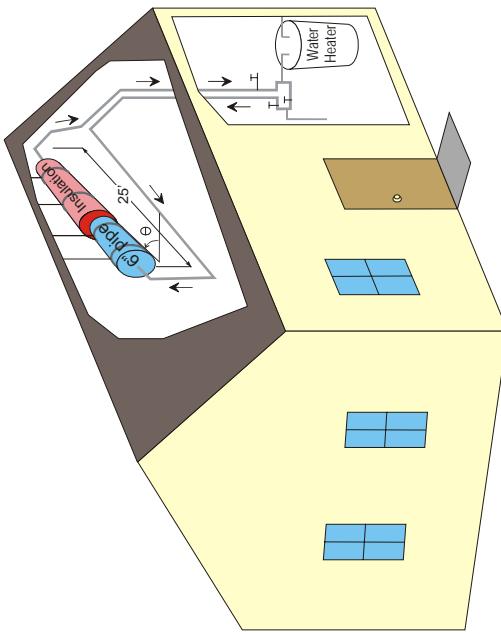
Energy-Efficient Low-Income Housing Program Overview

- \$1 million budget

■ Three-year scope, starting
June 2001

Program focus

- Energy-efficient and low-cost designs for low-income housing
- Strengths: partnerships, hands-on application, extensive field data collection



Attic hot water preheating



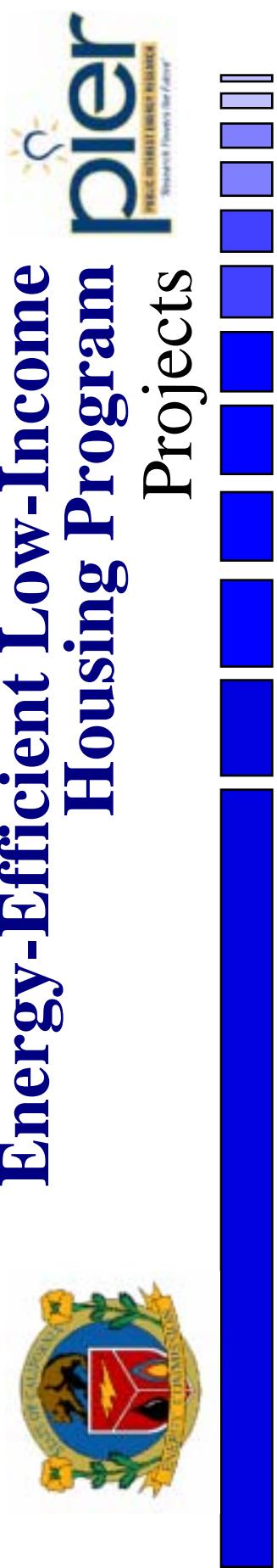
Energy-Efficient Low-Income Housing Program Problems/Opportunities



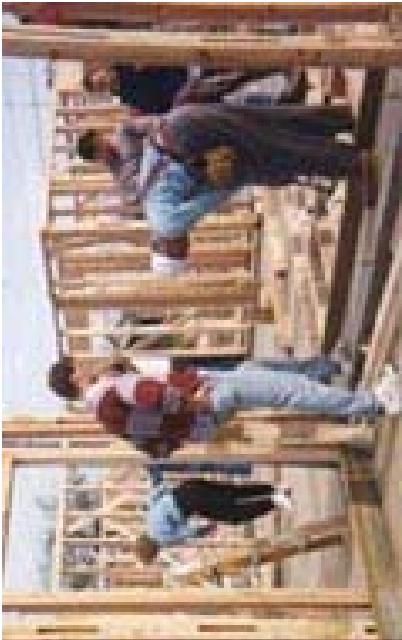
- **Low-income housing has unique issues**
 - Low first cost is crucial to ensure affordability
 - Clients may lack English skills and/or education and need easy-to-operate systems
 - Larger households raise different concerns for indoor air quality
- **But there are benefits to addressing issues:**
 - Energy costs are higher proportion of net income for low-income residents
 - Concepts are transferable to broader housing market



Energy-Efficient Low-Income Housing Program Projects



- Lowering Attic Temperature
 - Attic Heat for Water Heating
 - Ducts in Conditioned Space
 - Envelope and IAQ Interactions
 - Simplified HVAC Controls
 - Evaporative Cooler/Whole-House Fan Integration
 - Energy Efficiency through Community Design





Energy-Efficient Low-Income Housing Program

Industry Partnerships



- Low-income housing groups
 - Habitat for Humanity, Mercy Housing
 - » Able to provide test sites for projects and influence construction industry
- Manufacturers
 - Fleetwood Homes (manufactured homes)
 - » Manufactured homes are a key constituent of low-income housing, especially in rural areas
 - Ztech/RCS (residential HVAC controls)

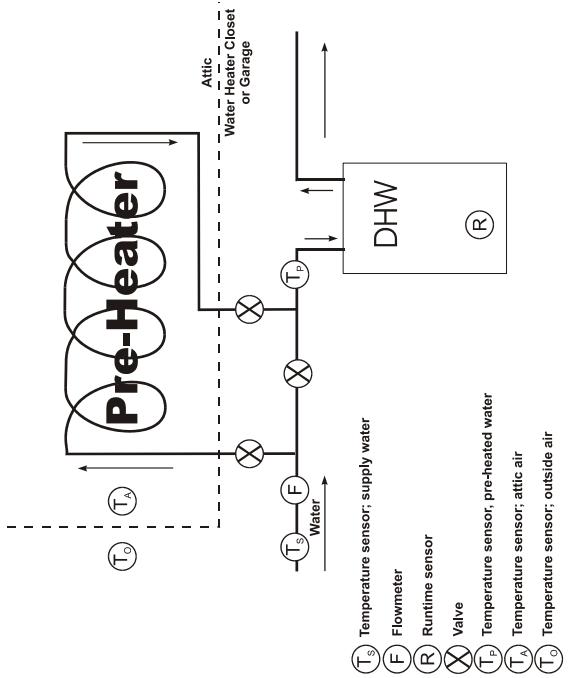


Energy-Efficient Low-Income Housing Program

Attic Heat for Water Heating



- Hot water can be expensive for low-income households
 - Inexpensive water heaters have high operating costs
 - Large households are more common
- Low-cost heat pipe boosts water heater efficiency
 - Water in collector heats to attic temperatures
 - Collector provides preheated water to water heater





Energy-Efficient Low-Income Housing Program

Lowering Attic Temperature



- Attic heat build-up increases cooling loads, especially in California Central Valley
- This project studies three options for reducing attic temperatures
 - Radiant barrier in two configurations (attic ceiling/floor)
 - Roof Spray System
- Study will provide data on cost and benefits in CA climates



Radiant barrier stapled to rafters



Radiant barrier above lay-in insulation



Energy-Efficient Low-Income Housing Program

Simplified HVAC Controls



- Temperature control in homes is often inefficient
- Existing thermostats do not meet the needs of low-income families
 - Language can be a barrier to reading thermostat operation manuals
 - Pre-programmed schedules are not always suitable for overlapping work schedules and higher occupant densities
- User-friendly “occupancy thermostat” saves energy
 - Default hot/cold settings
 - Preset “comfort” button calls for additional heating/cooling, then reverts to default settings
 - Design validated by measurement and characterization of thermostat use in 100 homes

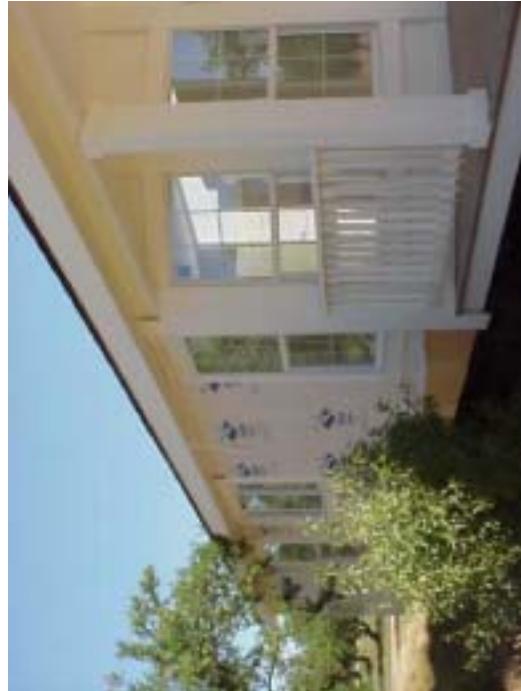


Energy-Efficient Low-Income Housing Program

Summary



- Program products address needs of low-income residents in California
- Participation from key charities and manufactured housing industry
- Research results will benefit mainstream housing market as well





Colored Cool Roof Project

Overview



- Interagency agreement with

- LBNL (and ORNL)

- \$1.97M 3 year project
began May 2002

- Project focus

- bring cool colored roof products to market

- combines research and industrial partners



Roofing material test facility at ORNL



Colored Cool Roof Project Problems/Opportunities



- **Cool Roofs have significant benefits**
 - *10-20 % average cooling cost reduction*
 - *6% average reduction in peak electrical demand*
 - *reduce urban heat island effect by 3 degrees*
 - *potential 5% reduction in ground level ozone*
- **Most people prefer traditional colors**
 - *White roofs not popular on pitched roofs*
- **Colored cool roofs can help**
 - *By lowering esthetic barrier to cool roofing products*



Colored Cool Roof Project

Technical Potential



cool

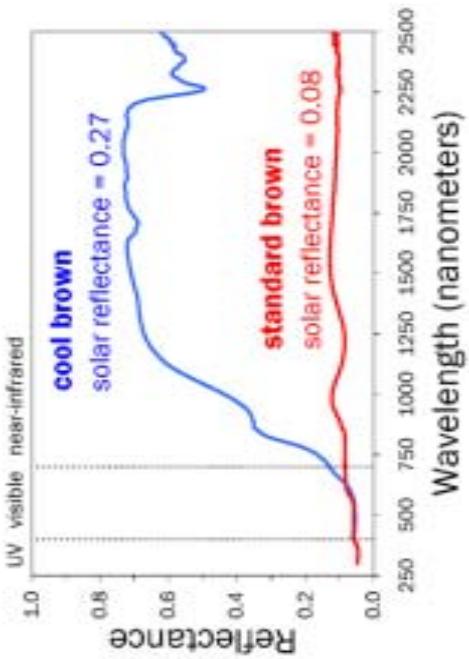


brown
metal
panel

COURTESY
BASF CORPORATION

solar reflectance = 0.27
thermal emittance = 0.85
roof temp - air temp = 36°C (65°F)

solar reflectance = 0.08
thermal emittance = 0.85
roof temp - air temp = 45°C (81°F)



- Cool Brown 16 F cooler than standard brown

- Cool green 12 F cooler than standard green



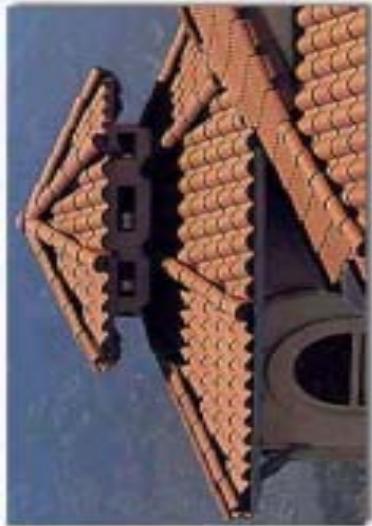
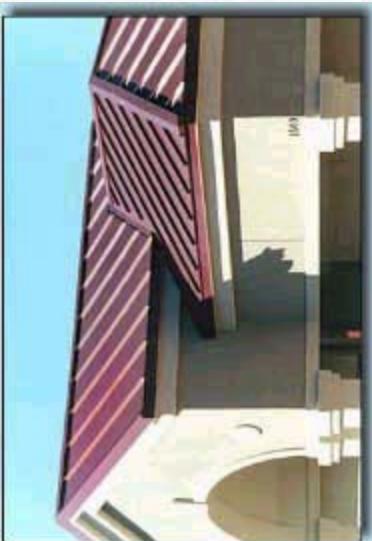
Colored Cool Roof Project

Products



Available now:

- Standing seam
- Clay tile



In development:

- Concrete tile
- Composition



EAGLELITE
Golden Eagle #199



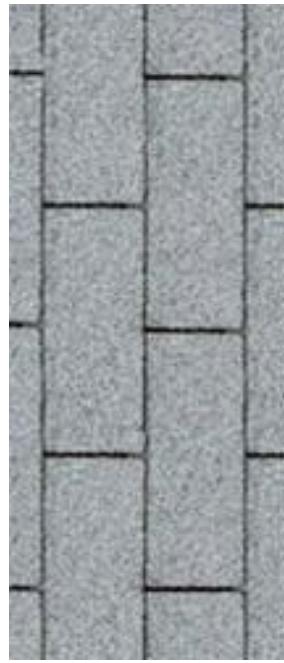
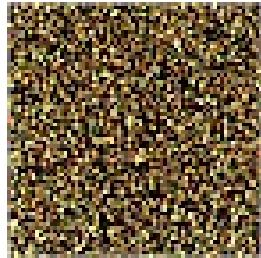
Colored Cool Roof Project

Development challenges



■ Composition roofs have greatest energy reduction potential

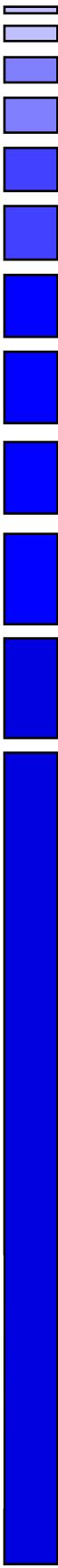
- 55-85F temperature rise (*10-35% reflectance*)
- 60-70% of existing roofs
- Replaced every 15 years (*on average*)
- Composition roof market barriers
 - Cost issues:
 - » *lowest first cost roofing product*
 - Inventory issues:
 - » *manufacturers want minimal stock*





Colored Cool Roof Project

Project Structure



How the project works:

- LBNL researchers identify pigments
 - Shepherd Color and Ferro contributing pigment candidates
 - LBNL preparing database of color combinations
- 3M, ISP manufacturing granules
 - significant proprietary manufacturing issues exist
- ELK, GAF manufacturing prototype shingles
- ORNL conducting field studies
 - Energy and weathering effects evaluated side-by-side
 - Habitat for Humanity for actual housing tests



Colored Cool Roof Project Expected Products



Expected Products:

- Colored Roofing Products prototypes

— *composition shingles*

— *concrete tiles*

- Basis for Title 24 compliance credit determination
- Products recognized by Cool Roof Rating Council





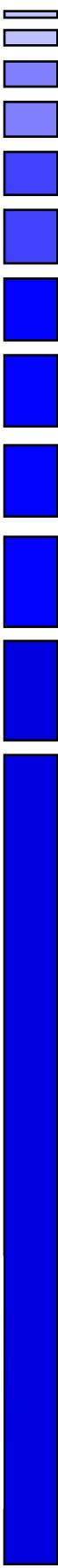
Collaborations Memberships - Current



- **Lighting Research Center (LRC)**
 - Close ties to the lighting industry
- **Gas Technology Institute (GTI)**
 - Gas Cooling
- **Air Conditioning and Refrigeration Institute (ARTI)**
 - Pre-competitive, industry led HVAC research
- **Center for the Built Environment (CBE)**
 - University based but has strong industry connections



Collaborations Memberships - Planned



■ National Lighting Publication Information Program (NLPIP)

— Testing of lighting products and dissemination of information

— Provide channel for dissemination of PIER research results

■ California Lighting Center

— CEC taking a lead role in development of California based entity

— Focus on applied research and provides working lab for manufacturers

■ National Center for Building Information Program

— Connection to large body of PIER funded research related to diagnostics and controls



Collaborations

Cross-Cutting With other PIER Teams



■ Demand responsive buildings

- Buildings/Integrated Energy Systems (IES)
 - PIER IES funding demand response (DR) tool review initiated by PIER Buildings
 - PIER Buildings will advise DR controls R&D underway in PIER IES

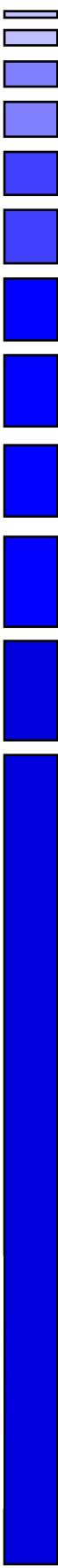
■ Reducing energy use in laboratory buildings

- Buildings/Industrial-Ag-Water
 - Assist in the review of intermediate and final deliverables
 - Energy performance metrics used in lab design intent tool also linked to Buildings performance metrics research



Collaborations

Cross-Cutting With other PIER Teams (continued)



■ Indoor air quality

— Buildings/Environmental

- Buildings took the lead role after coordinating with Environmental to develop a multi-state sponsored indoor air quality plan
- Buildings and Environmental served on the steering committee and industry advisory groups developing the plan
- Involves CEC/DOE/Air Resources Board/Department of Health Services
- Following development, Buildings and Environmental are jointly implementing the plan based on respective areas of focus (applications vs characterization)



Collaborations

Cross-Cutting With other PIER Teams (continued)



■ PIER Environmental

The Environmental Research Program Area focuses its project funding on better understanding and addressing the environmental effects of electricity generation, distribution and use.

In the subject area of IEQ, this PIER program area focuses on research that characterizes existing IEQ conditions in buildings, including the technology development necessary to properly identify and measure indoor air pollutants.



Collaborations

Future Collaborations

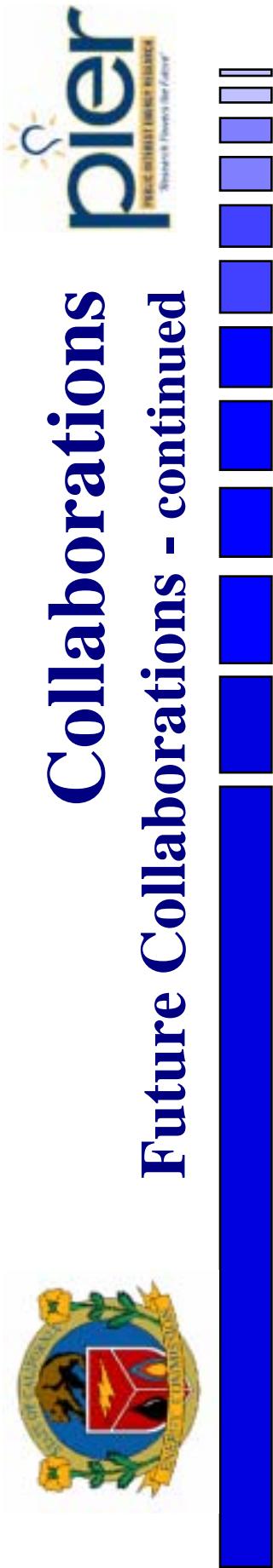


- IEQ - Meeting with other ASERTTI members annually to share respective research results
 - NYSERDA has indicated an interest in joining in the implementation of the plan
 - Iowa Energy Center is tracking the progress of PIER Buildings current IEQ solicitation
- Zero Energy Homes
 - Buildings/Renewables
 - Have had several planning meetings to identify issues and goals. Solicitation plans will be finalized next year



Collaborations

Future Collaborations - continued



■ Existing Residential Buildings Research

- PIER Buildings/DOE coordination based on an existing residential research plan developed by DOE.

■ California Commissioning Collaborative

- partnership with CCC will facilitate adoption of research results by CA utility programs, as well as state and private building decision-makers

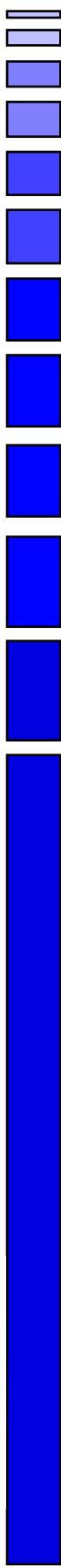
■ State Consumer Services Agency

- Multi-state agency collaboration to promote sustainable design and operation of state buildings



Market Connections

Who is the Market?



Anyone who has a role in using the product or getting the product to the user:

- Manufacturer
- Standards developer
- Designer/Architect/Engineer
- Builder/Developer/Contractor
- Building Operator/facility manager
- Public Interest Energy Efficiency Program (utilities and local providers)
- End Users (Homeowners, commercial building owners, tenant)
- Other (CCC, CHIPS, other state agencies, etc)



Market Connections

How do we Connect to Them?



- Key points at which we can most effectively influence the market connectedness of the research:

- RFP Scoping Stage
- RFP Proposal Stage
- Contract Management Stage
- When the Contract is Completed



Market Connections

How do we Connect to Them?



RFP Scoping Stage

- Determine what market issues/problems exist
 - Solicit industry input (including input from T-24 and other standards setting bodies)
 - Focus scoping studies on both technical and market barriers
- Target solicitations in areas based on market issues and problems
 - not on desire to do research
 - not technology driven



Market Connections

How do we Connect to Them?



■ RFP Stage

- Require proposals to:

- state market need
- justify how they have concluded that there is a market need
- focus on usefulness and market acceptability of the research product
- include appropriate market connected team members
 - provides a constant reality check on the market relevance of the project
 - facilitates the market transfer of the product at the end
- include initiation of market transfer actions by appropriate market actors



Market Connections

How do we Connect to Them?



Contract Management Stage

- Form appropriate project advisory committees (PACs) with representation from appropriate market interests
- Communicate intermediate research results to others in the industry that we are aware of that may have market perspectives
- Cross-cutting PACs
- Oversee market initiation tasks in the contract
 - » requirement for technical briefings
 - » brochures



Market Connections

How do we Connect to Them?



■ When the Contract is Completed

- Facilitate the transfer of research results to market implementers or entities that can support the market transfer of results
 - Electronically communicate results via our website and list serve
 - Introduce project results to utility energy efficiency program managers to identify and facilitate opportunities for utility collaborations
 - Introduce project results to utility Emerging Technology Coordinating Council (ETCC) and build partnerships for market initiation activities



Market Connections

Title 24 Standards



Examples of Connections with T-24:

- Residential Framing Factors for California
- Residential and Small Commercial Thermal Distribution Systems
- Advanced Duct Sealant Testing
- Cool Roof Monitoring
- Outdoor Lighting Baseline
- Development of Cool Colored Roofing Materials
- HVAC acceptance criteria development
- Skylight spacing based photometrics research



Market Connections

California Utilities



■ Utilities' Energy Efficiency Programs

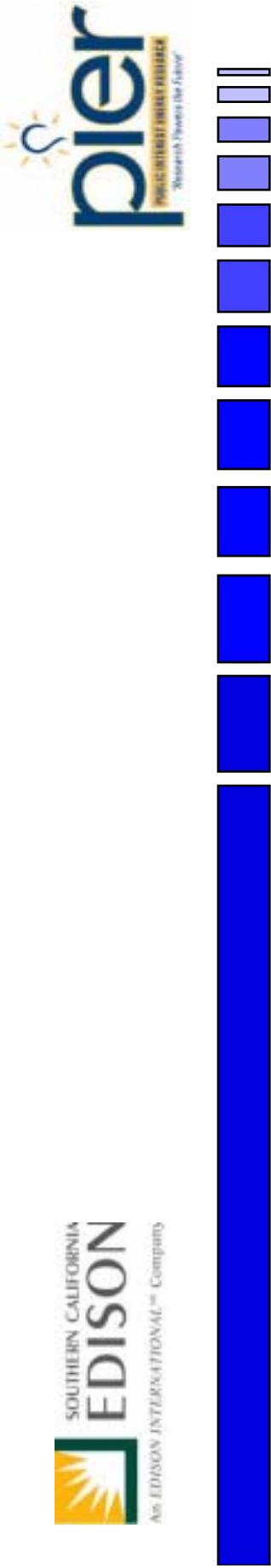
- Energy Centers (Training, information dissemination)
- Savings by Design

■ Emerging Technology Coordinating Council

- Creation of the ETCC was directed by the CPUC for the purpose of facilitating communications between IOUs and between the IOUs and the Energy Commission in the area of Emerging Technologies
- Example successes



An EDISON INTERNATIONAL™ Company



**Gregg D. Ander, FAIA
Chief Architect**

Manager

**Design and Engineering
Services**

Southern California Edison



Emerging Technologies Coordinating Council (ETCC)

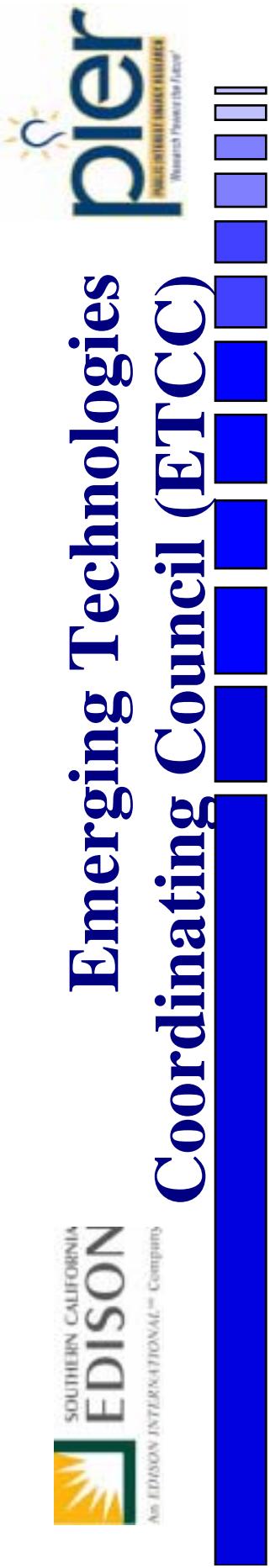
■ Mission Statement

- The Emerging Technologies Coordinating Council coordinates among its members to facilitate the application of energy efficient emerging technologies that will transform the market and benefit California ratepayers.

■ Established in 2000

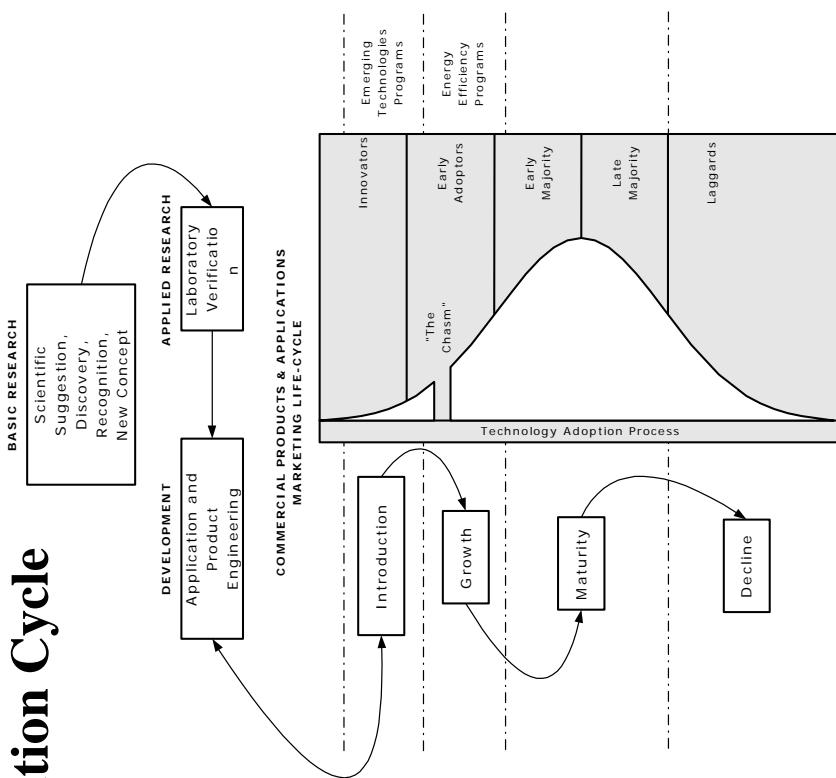
■ Members Include

- SCE, PG&E, SoCalGas, SDG&E and CEC
- Web Site www.ca-etcc.com

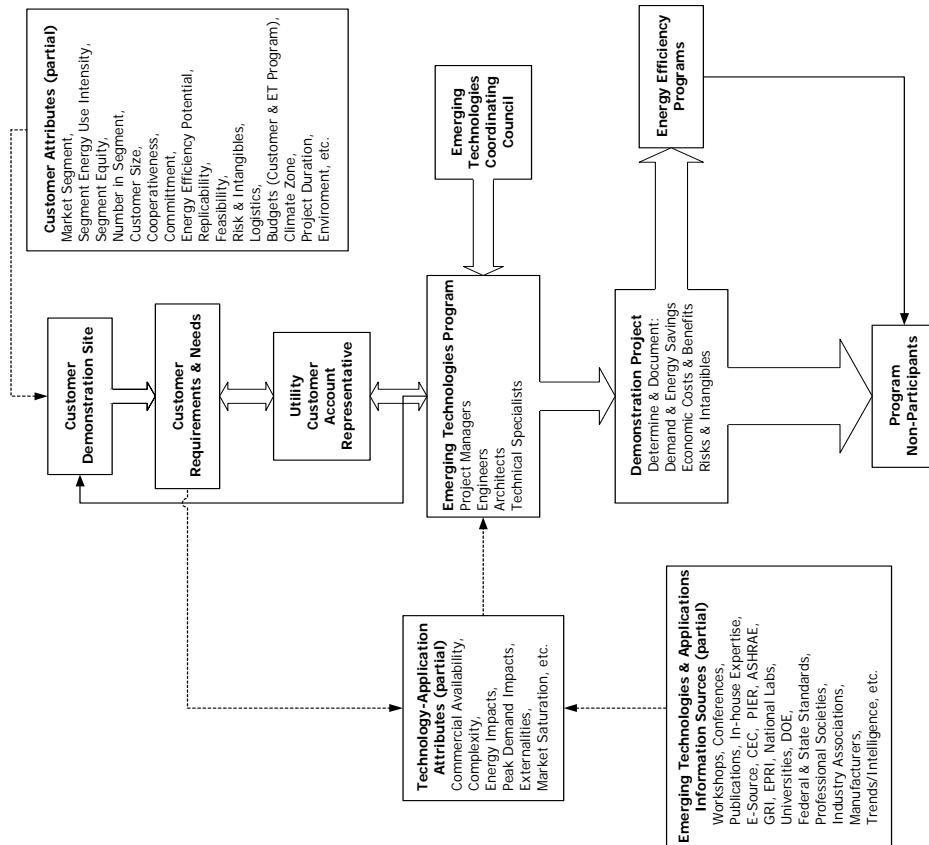


Commercialization of Emerging Technologies

■ Commercialization Cycle



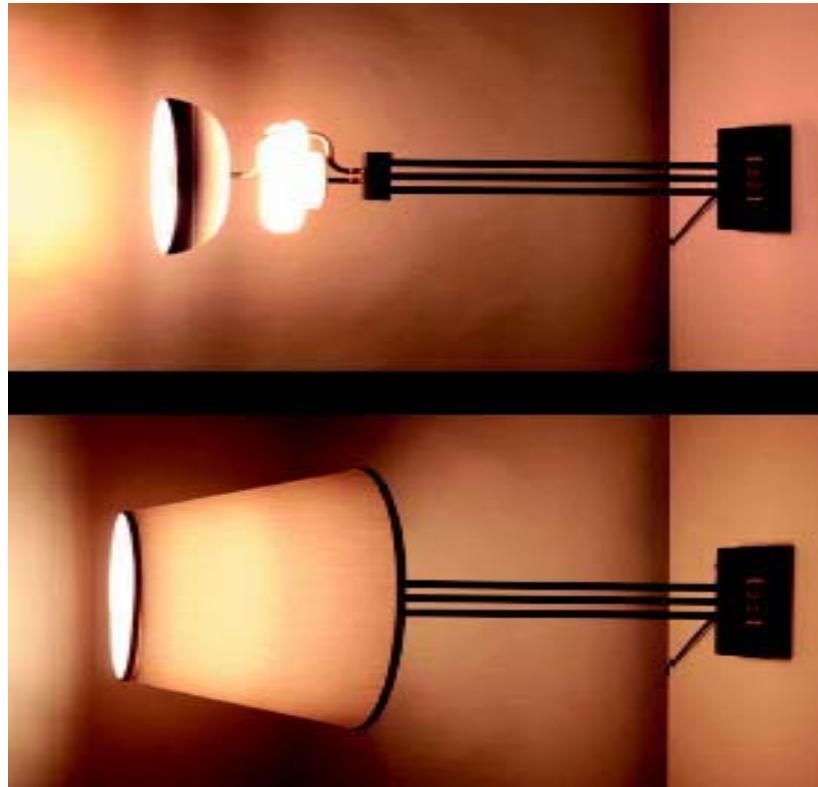
Demonstration Process



Berkley Table Lamp



- Berkley lamp developed under PIER contract 500-97-013
- Provides similar light output as incandescent or halogen lamps using 25 percent of the energy
- Initiated as a joint ETCC project to demonstrate and monitor lamp performance and acceptance in hotels and office settings



Berkley Table Lamp

(continued)

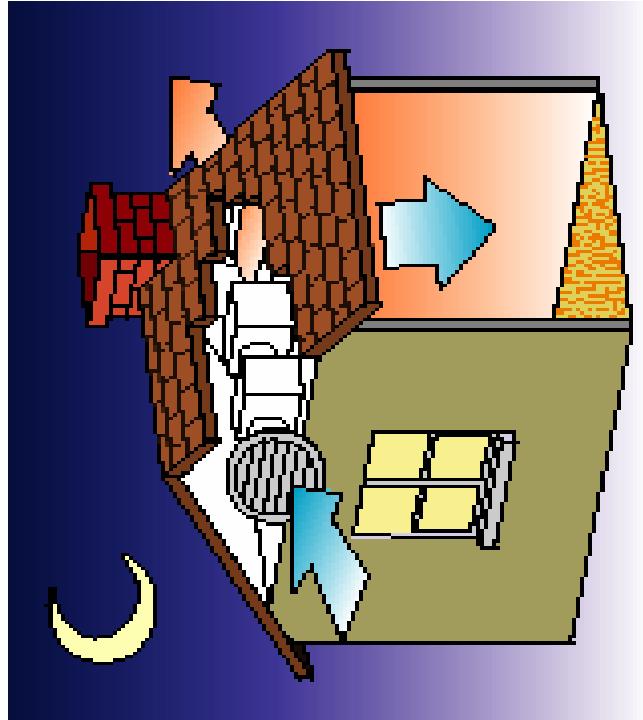


- The utilities worked with LBNL and a manufacturer to fabricate the first production run of Berkeley Table Lamps in 2001
- SCE has four sites: three with southern California hotels (Sheraton Costa Mesa, Fountain Valley Marriott Residence Inn and the Redondo Beach Hilton) and one with the City of Torrance. A total of 150 table lamps were deployed
 - Project nearing completion and a report is under development

Affordable Housing

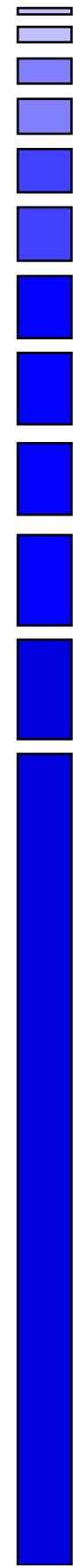


- **Habitat for Humanity**
 - Two sites (South Bay and Westminster)
- **Whole Building Approach**
- **PIER Developed Approaches Include**
 - “Night Breeze” (PIER contract 500-98-024)
 - Collaborating with ADM regarding PIER contract 400-00-036 (Low Income Housing)
- **Both Projects Currently in Design (Completion Expected 2004)**



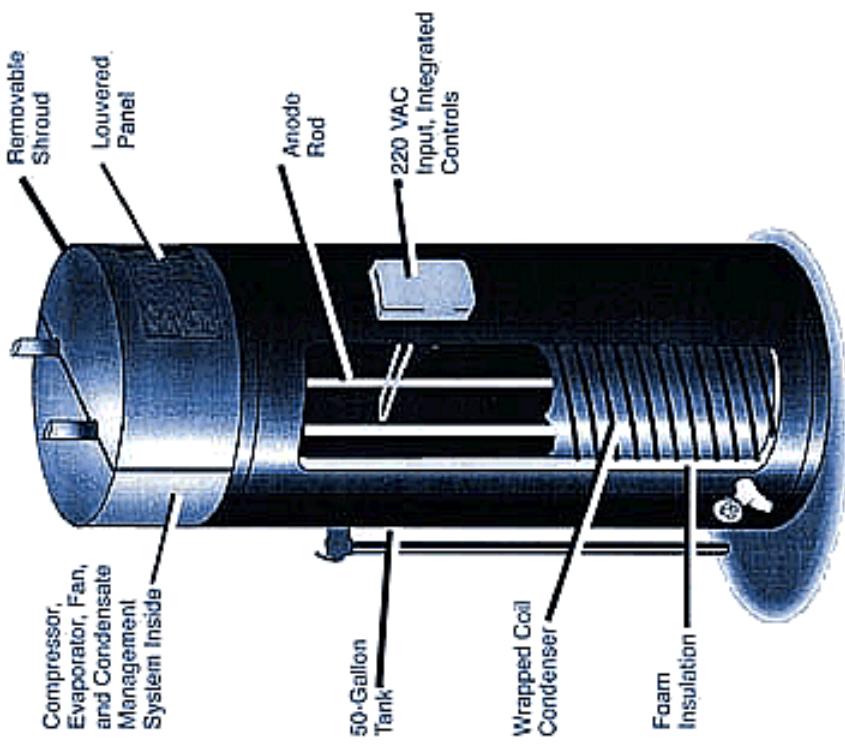
Southern California Edison

Advanced Heat Pump Water Heater



- Field test advanced heat pump water heater prototype
- Advantages

- Efficiency of HPWH twice that of conventional electric water heater
- Installation and maintenance performed by plumbing contractor
- Units developed under PIER contract (500-98-028)
- Four sites will be installed fourth quarter 2002
- Assessment to be completed late 2003



Advanced Concepts in Commercial Kitchen Ventilation



■ Objective

- Demonstrate efficiency opportunities in restaurants by applying strategies identified in recent commercial kitchen PIER project

■ Technologies

- Backwall make-up air system
- Perforated plenum make-up air system
- Variable speed exhaust system

■ Status

- Participants
 - » SCE, SDG&E, PG&E, Fisher-Nickel, Architectural Energy Corp., Captive-Aire Systems, Greenheck Fan Corp.
- Sites

Southern California Edison
➤ Currently evaluating Applebee's restaurants





Lessons Learned



- Researchers are not always the right ones to ensure market success

- The CEC cannot be the primary repository for research product
- Tech transfer actions need to be included in the scope of work

- Several projects have been initiated which integrate market partners and action along with the research

- Can't manage too many individual projects with limited resources

- Need creative contracting and management approaches



Lessons Learned



■ Proposers frequently propose research which seems duplicative of other ongoing or past work

- Require proposals to identify past and current related work and state how the new work will build upon it
- Forming strategic relationships with DOE, utilities, and industry is a critical activity of the program
 - » minimize duplication
 - » form partnerships to leverage value
 - » form market partnerships



Lessons Learned



■ Memberships do not always have value unless we are very active

- Be realistic when selecting memberships knowing the effort needed to impact the group work
- Leverage additional California value of the memberships by getting sharing the membership products with others (utilities, industry, etc)
- Have successfully applied this model to our LRC partnership



Future Work Near Term



- Develop strategies for the integration of residential commissioning into current business practices
 - Follow-on research based on currently funded residential commissioning protocols
- California optimized sensible cooler
 - Currently soliciting input from major equipment manufacturers
 - Partnering with DOE to ensure alignment with national appliance standards
- Indoor air quality research
 - Coordinated with other state agencies, other states and PIER Environmental



Future Work Next 18 months



- Standby loss, particularly related to residential appliances
- Follow-on research to integrate diagnostic tools into controls or other market products that are integral to the HVAC system operation.
- Zero Energy Homes
 - in coordination with DOE and PIER Renewables
- Collaborate with DOE on implementing a joint CEC/DOE existing residential building research agenda